



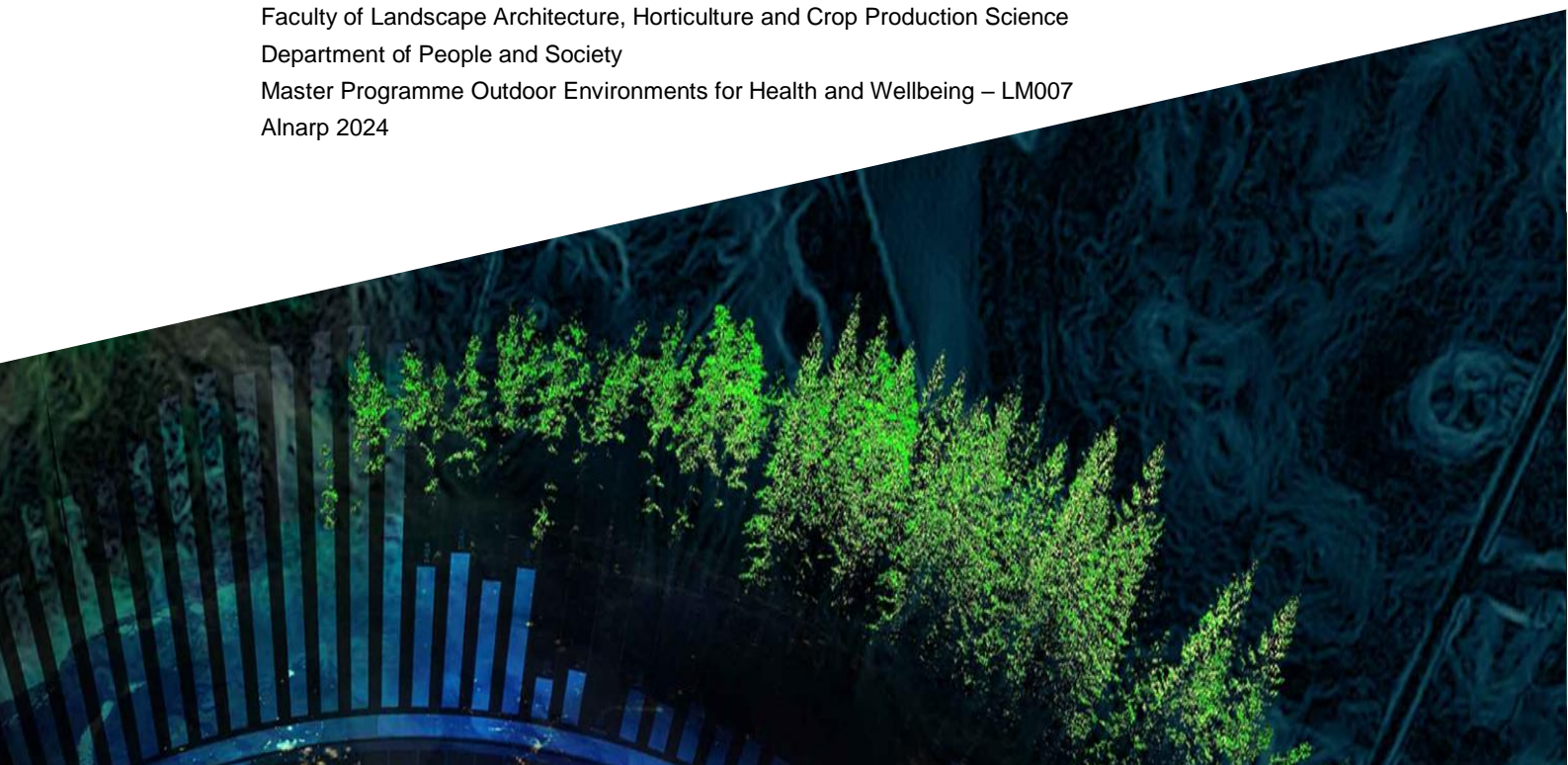
# The Non-Designed City

The role of urban micro-forests for human health and well-being

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Master Programme Outdoor Environments for Health and Wellbeing – LM007  
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# The Non-Designed City. The role of urban micro-forests for human health and well-being.

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## Abstract

The topic to this investigation has been the conflicting demands of a denser city vs. a green more sustainable city. To see if urban forestry, micro-forests and especially hybrid micro-forests are an opportunity to introduce restorative and instorative nature beneficial to human well-being and health in the modern city? To do this I have used stakeholder interviews to get in-depth knowledge from the professions on the thinking on micro-forests implementation, a questionnaire has been used to investigate if perceptions of urban greenspace visitors confirm the perceived sensory dimensions theory and finally the study used landscape analysis to investigate how benefits from micro-forests and hybrid micro-forests affects our sentiment and mood. The conclusion of the study is that micro-forests has an large potential impact on human health and well-being through physical activity and social interaction when constructing and caring for a micro-forest, thereby creating community engagement and bonding. Micro-forests also has an impact on our health and well-being by increasing our being in nature through eco-education and opening up other possibilities to access nature, thereby decreasing the demands on our attention. Finally micro-forests are strengthening our immune-systems by the higher degree of biodiversity a urban forest or a micro-forest enables.

*Keywords:* Urban Forest, Eco-system services, Tiny-forest, Biophilic Urbanism, Biophilic Cities, Biodiversity, Urban Nature, Urban Wilderness, Urban planning.

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# Abbreviations

SLU	Swedish University of Agricultural Sciences
PSD	Perceived Sensory Dimensions
ART	Attention Restoration Theory
SRT	Stress Reduction Theory
MKB	Malmö Kommunala Bostads AB
HBG	Helsingborg
ESG	Environmental, Social, Governance

# 1. Introduction

## 1.1 Background

A large majority of humankind is now living in modern cities and urban environments, as a consequence it seems that society has an increasing problem with stress and stress-related illnesses in the general public. Therefore we have a growing interest for nature and its restorative effects, but also for urban greenery, and how to design large cities in an effective way to create restorative green areas on small spaces to prevent stress and promote human well-being and health (Kaplan & Kaplan 1989, Kaplan 1995, Sonntag-Öström et al, 2014 p 351-352, Hedblom M et al, 2019, and Bratman G et al, 2019). As we will discover in this study; nature, and especially forests seem to have a positive effect on human health and well-being, both on higher cognitive functions as well as physiological functions such as blood pressure, heart rate, etc. (Hartig et al 2014, Frumkin et al 2017, and Yu & Hsieh 2020, p 1-2).

There seems to be a general agreement on the positive effects on humans of exposure to nature and biodiversity. A dilemma then occurs with growing cities and the influx of people towards urban areas. The growing demand for urban space and a need to build denser to accommodate urban growth takes its toll on available green space within the expanding city limits (McDonald 2023, Beatley 2008, 2011, and 2016, Browning et al, 2014 and Kellert et al 2008). Larger parks, areas between buildings and other free green space become less prioritized in city planning (Buffam et al, 2022). Together we will therefore investigate how to include the human need of biodiversity and wilderness in urban areas. The study will look at micro-forests and hybrid micro-forests to see if these concepts are an effective way to introduce nature in dense modern cities and how these micro-forests and hybrid micro forests can promote human health and well-being. To do this the study will lean against some theoretical foundations described below.

## 1.2 Theoretical Framework

The study will mostly focus on the theory of perceived sensory dimensions and the attention restoration theory (see below) to investigate the effect on human health from being in micro-forests. But other theories and concepts are important for us to know about to understand the logic behind our reasoning and the chain of cause and effect from being in nature towards increased well-being.



Biophilia, Biophilic design and Biophilic urbanism are concepts or strategies that try to create conditions in urban areas as nature-like as possible or as beneficial for human restoration, well-being and health that nature is. Biophilia is the overarching idea formulated by Edward Owen Wilson in his book *Biophilia* (1984) that humans has an innate feeling for nature and that it therefore is beneficial for humans to be in nature-like environments. Biophilic design is the concept of creating natural environments within urban areas, with a focus on different parts in a city. That could be on the inside of buildings or green walls or roof-top gardens on the outside of buildings, it could be to plant trees in streets or to create distance between pedestrians and traffic, whereas biophilic urbanism is more concentrated on larger areas, such as regions, whole cities or districts within a city. The concept of biophilia is largely similar to the Savannah-hypothesis (Orians 1986) and the work of the Kaplan's (Kaplan & Kaplan 1989) on what aspects in the natural landscape that is beneficial to human health.

Place attachment and place bonding is of great interest when we discuss human well-being and health within an urban landscape, since collective activities counter the loneliness that exists within larger cities as well as it fosters teamwork and strengthening other important values to our perceived health, such as a heightening self-esteem, etc. (Oh et al 2020, Pedretti-Burlis 2007, Veerhoeven et al 2023, and Scannell & Gifford 2010, 2013). If introducing micro-forests or other green infrastructure within urban landscapes can have a secondary community-building effect beyond increasing biodiversity and mitigating climate effects it should be of interest to stakeholders in the planning and development of cities.

Eco-system services are a concept that is becoming more and more in use when discussing or theorising about urban ecosystems. You are then looking at eco-systems as providing services to the inhabitants of the city (Elmqvist et al 2015, and Subiza-Perez et al 2020), or benefits (Bengtsson & Grahn 2014, Grahn & Stigsdotter 2010, Bratman et al 2015). It is also possible to look at the attractiveness of an urban eco-system as one in which the urban landscape gives the citizens affordances (Gibson 1979, Ch. 8, and Grahn et al 2010) about its attractiveness by what it offers. The eco-system, or landscape, or environment that you are visiting provides you with something that you value. The place should to be perceived as attractive, to use the term of Kaplan (1995, p 173), be compatible with your desires. It should offer you benefits and features that make you want to be there (Grahn & Stigsdotter 2010, p272). The benefits derived from eco-systems can be of different kind, it could be recreational or restorative when visiting a specific eco-system. It could be the provision of clean water or fresh air, and it could also be control of climatic effects in urban areas such as green rooftops protecting the city from heath island effects (Buffam et al 2022, Subiza-Perez et al 2020, Elmqvist et al 2015, and Bratman et al 2015). Eco-system service are connected to biophilic urbanism through the process that well design biophilic cities could give an abundance of different eco-system services increasing our modern urban landscapes ability to protect itself from climate changes, decrease in biodiversity, pollution and heat island problems (Kambo et al 2019, Table 1, p 3).

The theoretical concept that the study will mostly use to investigate how micro-forests affect human health and well-being will be based on theories of Perceived Sensory Dimensions (PSD) which is a concept on how we perceive the environment around us, and on two theories on how we respond to stressful

environments. The Attention Restoration Theory (ART) that says that we, when exposed to a demanding environment for too long, need to relax our cognitive attention not to get ill and that this is best done with effortless stimuli in nature. The Attention Restoration Theory (ART) shows us that our cognitive abilities and memory, functions better after exposure to nature. Secondly, the Stress Reduction Theory (SRT) show us that our body/physiology performs better when exposed to nature, because when we are exposed to nature our nervous system reacted to an innate connection to nature, affecting our heart rhythm, blood pressure, etc. (Ulrich 1984, Bratman et al 2015 and Sonntag-Öström et al 2014). Basically these theories are telling us that our body and mind becomes better by being in nature and then supposedly also having a restorative effect.

The perceived sensory dimension of landscape has been developed by Patrik Grahn and others (Grahn and Stigsdotter 2010, Grahn et al 2010, Ch. 5, p 126-128, Stigsdotter et al 2017, p 3, Peschardt & Stigsdotter 2013, p 32). The dimensions developed by Grahn et al show us how people perceive their surrounding environment and what dimensions or features that are valued as restorative and that they prefer visiting or being in. When discussing what dimensions and features that affects us in the urban landscape we will also be influenced by the pyramid of supportive environment by Patrik Grahn (Bengtsson & Grahn 2014, Palsdottir 2014, p 19-20, Stigsdotter & Grahn 2002, p 64-65). The pyramid is showing us stages of social interaction people prefer when in different stages of stress and illness.

These theories are evolved from theories of the importance of our evolutionary background as described by Appleton (1975) and the ideas of ART and SRT that are developed by Kaplan & Kaplan (1989) and Ulrich (1984), to see more about these theories take a look at Bengtsson & Grahn (2014, p 2), Sonntag-Öström et al (2015, p 608), and Grahn et al (2010 Ch. 5, p 124).

Both ART and SRT accentuates that restorative environments are connected to the demands on our attention that the environment has on us. The more complex an environment is the more demanding it is on our direct attention increasing stress, especially over time. Therefore we should pay attention to stress reducing environmental characteristics on how to reduce demands on our attention and to find a balance in complexity when assessing landscapes from a restorative perspective.

### **The eight Perceived Sensory Dimensions**

<b>Perceived Dimensions</b>	<b>Description of Dimensions</b>
1. Serene	Peaceful, safe, secure and signs of care
2. Nature	Wild nature
3. Rich in species	Variation of animals and vegetation
4. Space	Entering another coherent world
5. Prospect	Open space with places to be
6. Refuge	A secluded place
7. Culture	Signs of the work from former generations
8. Social	A place of social interactions

*Figure 1. Description of the eight perceived sensory dimensions of a place (Grahn et al 2010, p 127, Palsdottir 2014, p21)*

The study will also use the somewhat modified terminology of the PSD-theory from Stoltz & Grahn (2021) and Stoltz (2019), to investigate the possible effects on human health and well-being from the affordances offered and the benefits given by the studied environment, the hybrid micro-forest which we will look into in detail in chapter 2. The study is interested in the dynamics between the restorative dimensions and the instorative dimensions in the environment (Stoltz and Grahn 2021 and Stoltz 2019). In their work, they characterize the dimensions of Sheltered, Natural, Serene and Cohesive as Restorative; and the dimensions Diverse, Social, Cultural and Open as Instorative (Stoltz 2019 and Stoltz & Grahn 2021 p 39). An instorative environment is stimulating or edifying and a restorative environment is, well it is restorative.

These dimensions and the aforementioned grouping can in different combinations be strengthening for our mental as well as bodily faculties, for our health and well-being both psychological and physical. This dynamics is also described by Appleton (1975) and by Grahn et al (2010) in their discussions of Prospect vs Refuge as basic driving forces of human beings in their perception of a landscape. This driving force is also described and discussed in the work of Morgan (2010), where he theorizes about children's development cycles as a search for new impressions and experiences in an outward directed explorative phase combined with faces were the child becomes tired or scared retreating to a safer environment (Morgan 2010 p15, fig.1). This dynamics will be in focus during this study and its investigation of benefits and effects from hybrid micro-forest plantations in urban landscapes. The study will look specifically on activities and inspirational aspects of the environment influencing human health and well-being.

### 1.3 Aim

The aim of this study is to increase our knowledge in and to investigate the concepts of urban forests and micro-forests to see if these concepts are an opportunity to effectively introduce restorative and recreational wilderness within city limits.

The point of departure is that the introduction of micro-forests within city limits has a positive effect on several important factors of human well-being; such as access to green biodiversity giving an opportunity for strengthening of the immune-system, or being a place for nature experiences serving as a preferred environment for restoration, but also to be a place for meaningful play, activity and teamwork developing human self-confidence and self-esteem.

The study will also investigate an assumption that the implementations of micro-forests have a very important effect on the local community by being a project that could and should be executed voluntarily thereby increasing social interaction, engagement and sense of place in the community, with positive effects on human health and well-being.

The research questions will therefore circle around what the potential and benefits of implementing urban micro-forests in modern cities are:

1. How is green infrastructure promoting health in a dense city?
2. How are micro-forests and more specifically hybrid micro-forests promoting health?
3. Are city-planners and stakeholders aware of the possibilities to implement urban forestry and are they aware of its possible beneficial effects on human well-being?

Implementations and limitations for this study is that we will try to select some geographically close cities for our case study. Malmö is selected with Helsingborg as a comparison in the southern part of Sweden.

## 1.4 Method

The investigation started with a general literature search on biophilic design and biophilic urbanism, on micro-forests and the Miyawaki-method and on concepts such as urban forestry, urban wilderness, urban nature and biodiversity. The primary sources have been Google search and Primo search service through SLU.

The study are using biophilic design theory and comparison of the modern dense city centre with older city centres to identify restoring elements that also are existing within a hybrid-micro-forest or that can be used to build in affordances in the hybrid micro-forest creating an environment that is in accordance with the inorative and restorative PSD-theory of Staoltz & Grahn (2021).

The study continued with a landscape analysis and an immersion into several of the analysed urban landscapes such as the dense city, and the hybrid micro-forest to experience these environments with a multi-sensorial analyse of how humans can perceive such urban landscapes. The study is inspired by Cristine Tudor (Tudor 2014), and her landscape assessment wheel (Tudor 2014 fig 1, p 9) but also by the work of Mari Sundli Tveit and Åsa Ode Sang (Tveit & Ode-Sang 2014) and of course by Patrik Grahn and others around the Perceived Sensory Dimensions (Grahn et al 2010, Grahn & Stigsdotter 2010 and Stoltz & Grahn 2021).

To get in-depth knowledge the study have used qualitative research interviews, with a semi-structured interviewing technique and open-ended questions with stakeholders and professionals in urban planning in Malmö and Helsingborg to get actual information on green infrastructure and micro-forest implementations. Policy-papers and planning documentation have been a part of the studied literature to get an impression of the cities official vision on green infrastructure and environmental values. The study has used the interview guide and interview techniques described by Svend Brinkman and Steinar Kvale in (Brinkmann & Kvale 2015).

Finally the study have used a questionnaire (see appendix 1) to capture visitors' perception of being in a nature area or more specifically in Ankarparken, trying to capture how they felt before and after visiting the park. Getting first-hand information on what dimensions and benefits people value and to have some knowledge on what benefits could be applicable in a hybrid micro-forest.

## 2. A Greener, Denser City! A Contradiction in Terms or a Real Possibility?

Urban growth worldwide and the following necessity of densification in the urban landscape has the possibility to create a number of health issues such as stress-related illnesses, and a growing amount of mental and physical disorders (Hartig et al 2014, Frumkin et al 2017 and Yin et al 2023).

There are some ways to mitigate these effects by incorporating natural features in urban infrastructures, such as the streetscapes, or in the construction of buildings with green walls and roofs a movement that is growing in modern city planning. Another option is to build green. To construct parks and other green infrastructure. This is of course a dilemma when the city needs more space for accommodating the influx of new citizens. The use of micro-parks have become of growing interest in urban design thinking but also the use of micro-forest should be an extremely interesting way to introduce nature in dense cities.

### 2.1 Biophilic Design and Biophilic Urbanism: A Rising Trend within Urban Planning

Biophilic design and biophilic urbanism is of growing interest in modern city planning (O'Sullivan et al 2023, and Beatley & Newman 2013), as we can see in the rising number of national and international cooperative action between cities ([viablecities.se](http://viablecities.se), [netzerocities.eu](http://netzerocities.eu) and [c40.org](http://c40.org)) and in Timothy Beatleys network of biophilic cities, such as Singapore, Barcelona and Edinburgh ([biophiliccities.org](http://biophiliccities.org)). Biophilic design focuses on incorporating natural elements into buildings or street environments; it could be the following six elements that scholars such as Kellert (2008), Kellert & Calabrese (2015) and Browning et al (2014); to describe elements of biophilic design (Wijesooriya et al 2023 p 2, Hidalgo 2014):

- 1) **Environmental features** (water, air, colours, views, etc.).
- 2) **Natural shapes and forms** (trees, bushes, spiral forms, no straight lines).
- 3) **Natural patterns and processes** (this could be to incorporate sensory variability or fractal patterns).
- 4) **Light and space** (Natural light and openness in shapes of public spaces and buildings or other constructed environments).
- 5) **Place-based environments** (this could be history and geography that is coherent to a place, it can be the spirit of a place), these environments give

meaning and is connected to emotions and feelings (Hung & Chang 2022, pp6, 8-9) that if positive can be restorative.

- 6) **Evolved human-nature relationships** (this refers to concepts described by Appleton (1975), by the Kaplan's (1989) and in the perceived sensory dimensions by Grahn et al (2010) and describes our preferences for prospect and refuge, for complexity, order and security as well as possibilities for exploration).

Some characteristics of biophilic design and biophilic urbanism derived from prominent scholars such as Benyes, Kellert and Beatley (Hidalgo 2014) that could be good to include when to plan for, design and develop biophilic cities can be features such as; plant life and animal habitats, trees, sensory variation, natural light, water, the social aspect of human connection to a place, quiet places, seasonality and colours, savannah type systems and possibility to immersion into eco-systems, tree canopy within the city, urban forests and ecology parks, etc. (Hidalgo 2014 p 537-540).

To pierce deeper into the thoughts of biophilic cities or biophilic urbanism we can start with the words from one of the most well-known proponents and scholars of biophilic urbanism, Timothy Beatley from the University of Virginia. He looks at biophilic design not as details in the city environment but as a regional system at least city wide (Beatley 2016). He promotes the necessity and benefits of transforming the urban landscape towards a more natural state, and according to Beatley the benefits of cities inspired by biophilic urbanism are threefold; 1) it is beneficial for human health and well-being to spend time in a more natural environment, 2) connected with this increased well-being from a biophilic city is that productivity as well as creativity increases making a cost/benefit analysis more positive, 3) last but not least, an urban landscape promoting green and blue values becomes much more resilient to disturbances in the wake of a changing climate, such as storm water drainage and resistance to heat island effects (Beatley 2016, Ch. 1).

Since a large percentage of the world-population live in cities and mega-cities are expanding around the world. Urban resilience are a hot topic for policy makers (UN Habitat, European Commission, European Environment Agency and Regeringskansliet), The academic study of resilience of cities through biophilic urbanism and biophilic design is also very much on the rise, see for example a study of Peter Newman, Timothy Beatley and Heather Boyer of the resilience of cities (Newman et al 2017). Regarding the benefits mentioned by Beatley about the biophilic city, we can also point to studies focusing on calculating the economic benefits of implementing biophilic design fully into the urban landscape and how they mention, for example gains through less crime, etc. (Ryan et al 2023). A study performed by the consulting company Terrapin, a company partly founded by Bill Browning, the author of "14 patterns of biophilic design" from (2014) and one of the most well-known proponents of implementation of Biophilic design in cities. Another interesting study regarding economic benefits is one looking at the costs and economic benefits of trees in an urban environment (Song Ping Xiao et al 2018).

What constitutes a city influenced by biophilia? According to biophilic urbanism, or according to the work of Timothy Beatley to be more correct and

specific, some attributes that defines a city inspired by biophilic urbanism are that such a city strive to live within its ecological limits, it is locally and regionally self-sufficient, it promotes a sustainable life-style, it has a high quality in neighbourhood and community life, and it is designed to function with nature (Beatley 2016, Ch. 2, and box 2, 4, p 25). Some of the design elements that you have to think about to create a biophilic city is the connection with nature, to incorporate natural forms, to think about light and space in the construction of buildings, city blocks and districts. For example you have to think about how to incorporate blue elements in the city and how to build corridors of sight for pleasant views of green spaces, water or landmarks in the urban landscape. It is also important to think about and incorporate olfactory sensory stimuli, such as flower beds, insect,- and bee-friendly plantations, bird friendly house walls, etc. (Browning et al 2014 Table 1 p 12, and pp 8-20, 23, 24-51, and Beatley 2016 box 2,1 and 2,2 p22-23). The modern city has a continuing need to build in nature into the city. Our increasingly hectic tempo and stress-filled lives; in school and at work, with our senses crowded by impressions from traffic, from noise and from the encounter of endless amounts of interactions with other city-living human beings creates a need of peaceful surroundings and an opportunity for restoration of our sensory capacities (Mather 2011, Hedblom et al 2019; Grahn & Stigsdotter 2010; Kaplan & Kaplan 1989). Therefore the experience of our city becomes important and as it is described in a very well-known book “The Image of the city”, we experience our city through our known and unknown senses, processing the landscape and its different elements, its pathways, its district and blocks, its landmarks comparing the impressions in our memory giving us meaning, making it possible to orient ourselves and value our city (Lynch 1960 Ch. 1).

Many of the characteristics mentioned in biophilic theory to build a city that foster health and well-being exists in the micro-forest and especially in the hybrid micro-forest that we soon will examine.

## 2.2 Malmö City, The Place and Experience

Malmö is an interesting city to study in respect of its conflicting state. It has one of the lowest green coverage of all municipalities in Sweden, according to Buffam et al (2022), but at the same time it has a large potential for urban wilderness. Malmö is an old industrial town that has undergone a tremendous change the last couple of decades. Malmö has due to this rapid change many old industrial areas now deserted and retaken by nature. This is also an opening for new development of nature within the city, as in the older parts of the industrial harbour or the open fields and sea meadows near the city centre. These places are as we will see later specifically suited for plantation of new hybrid micro-forest, since there are many businesses that could serve in partnership with the municipality to implement micro-forest plantation or as is the case in the open sport fields called the "Limhamnsfälten" that through their many sports association active in that location is exemplary for civil society engagement, a prerequisite for a successful micro-forest plantation. These interesting possibilities in Malmö for new green developments also make it interesting investigating the official stand in these issues by stakeholders active in urban planning.

Malmö's new development plan has a very large focus on green development as we can see on the fact that two out of three orientations in the planning document have a focus on green development (Malmö stad 2023, Översiktsplan, p 7, 12-17). On the following pages it continues with five out of five strategies in the document focusing or strongly mentioning aspects pointing out human wellbeing, recreation and the importance of biodiversity for a healthy life environment in an urban landscape (Malmö stad 2023, Översiktsplan, p 19, 23, 27-28, 29-31, 35-36). For example we can see that under the strategy "life in the city" it is mentioned that more meeting-places, parks and nature areas shall exist, under the strategy "built environment and cultural environment" the document states that the coastline shall be opened up and that the 3-30-300 model shall be implemented. This model states that you shall be able to see at least 3 trees from where you live, every neighbourhood should have a 30 percent canopy coverage and it should be no longer than 300 meters to the nearest park or green space (Konijnendijk 2021).

In the strategic planning document for the blue and green infrastructure development of Malmö from 2019 (Malmö stad 2019, Plan för Malmö's gröna och blå miljöer), you can once again see that environmental concerns are integrated into the governance documents of the city. This document which is coordinated with the strategic development plan, see above, and the environmental programme of Malmö shall be based on an eco-system service view and has four main goals; 1) To promote health and well-being of the citizens of Malmö, 2) To climate adapt Malmö, 3) To strengthen biodiversity, and 4) To strengthen the participation of the citizens of Malmö (Malmö stad 2019, Plan för Malmö's gröna och blå miljöer).

It is interesting for us that the first goal mentioned is that of promoting the health and well-being of people living in Malmö. In other planning documents we have seen that directional goals and strategies have been focusing on increasing possibilities for activities and meeting places in a green environment, for supporting landscapes and supporting biodiversity, in conclusion the vision and goal of other planning documents is often focused on environments that will promote the health and well-being of citizens when used, such as better access to the shore-line, more trees and closer to recreational areas. But in this document we see that human health and well-being are being explicitly mentioned and that it is mentioned in front of other goals.

This document describes the positive effects on humans from being in nature, listening on birds singing, looking over water (Malmö stad 2019, Plan för Malmö's gröna och blå miljöer, p 10). The document mentions actions and environments that need to be protected, evolved or done to promote the above mentioned directional goals. This could be accessibility of park and nature areas, green streets and school yards, noise protection, storm water management, increasing and protecting valuable biotopes for biodiversity such as wet lands, meadows, marine environment and older trees in the landscape. Finally participation, trust and engagement are emphasized. To involve citizens in maintenance of green and blue environments create place attachment and belonging, strengthening the democratic society.

The document then goes further into details of measurable goals such as sizes of and distances towards green areas for the citizens, such as that within 300



meter from a residential area there should be a park or green area of at least 0, 2 hectare large and 30 meter wide, etc. (Malmö stad 2023, Översiktsplan, Malmö stad 2019, Plan för Malmö's gröna och blå miljöer, p 19). Other factors influencing human health and well-being are also targeted, such as accessibility to marine environments, increased use of green corridors and spending time in nature. Safety and security is also mentioned as a prerequisite for well-being and the accessibility of urban green environment.

Now it is time to go from the world of visionary planning documents and statements of directions into the real world. Together we will take a tour in the urban landscape of Malmö to investigate how a dense city affects people and how perceived health and well-being can be affected by different design elements. The study also compares the modern city with older city centres to identify elements affecting human perception of the cities restorative functions.

### 2.2.1 The Dense City: The Western Harbour - A Case Study

The Western Harbour (Västra Hamnen) district is developed as a rejuvenation of an old industrial site and shipyard from the 1960- and 1970s, when Malmö was known for ship-building and as an industrial town. That changed during the late 1970 and 1980 with a sharp decline in the economy and a de-industrialization process taking place. Malmö has since been transformed to connect the city centre with the sea and with a connection to Denmark from Malmö. The first part of this transformation was ready 2001 but we are in this investigation looking at parts of the Western Harbour developed later when the ideas of a dense city has been introduced in the planning and building of new developments.



Figure 2. Map of Malmö with Västra Hamnen and Masttorget in the upper right and Limhamns Sjöstad marked at the lower left side. In between is Limhamnsfältén, a place we will talk about later. From Google map.

To study the development of this district the first reflection of the dense city was an astonishment over the change in the landscape with completely new buildings and a feeling of being flabbergasted on how narrow and tight these streets. Leaving that behind I am descending in this part of Malmö, Western harbour a day in February 2024. It is a typical winter day in Skåne, with a cloudy grey sky, somewhat rainy and with dark wet asphalt in the streets. It is not so cold, around 8 degrees Celsius with a light wind from the east. A curiosity is that I was traveling from the less urbanised commuter villages north of Malmö, as I have done for many years of commuting, and reflected over that it was, as it usually is, a three degree difference from outside the city centre. Maybe a telling sign of the “heat island” phenomenon that is a problem for many cities and urbanized areas around the world (Rötzer et al 2023).

I inserted myself in the neighbourhood close to Turning Torso, the corkscrew-shaped building, pretty much in the centre of the west harbour district. I am going southward to get to the newer developed areas walking slowly making a multi-sensory mapping of the area around Masttorget that is a new development. At first I do not distinguish any particular smells, later closer to the square I smell food and hear people talk close to some open restaurants. On a nearby street I hear the noise of someone delivering produce to a store, some cars in the distant and children playing at a schoolyard or maybe a day-care centre. Behind me I hear rain drops on the roof of some temporary construction. Above me I can hear seagulls and crows making fuzz. It is all quiet normal sounds of the city not disturbing and not really pleasing either.

Yet I get an experience that is not all together pleasant. In some ways it seems that you are looking at Potemkin scenery. There is something that is not right but you are not sure what it is. It is meant to be cosy and it almost is but it somehow feels fake or false.

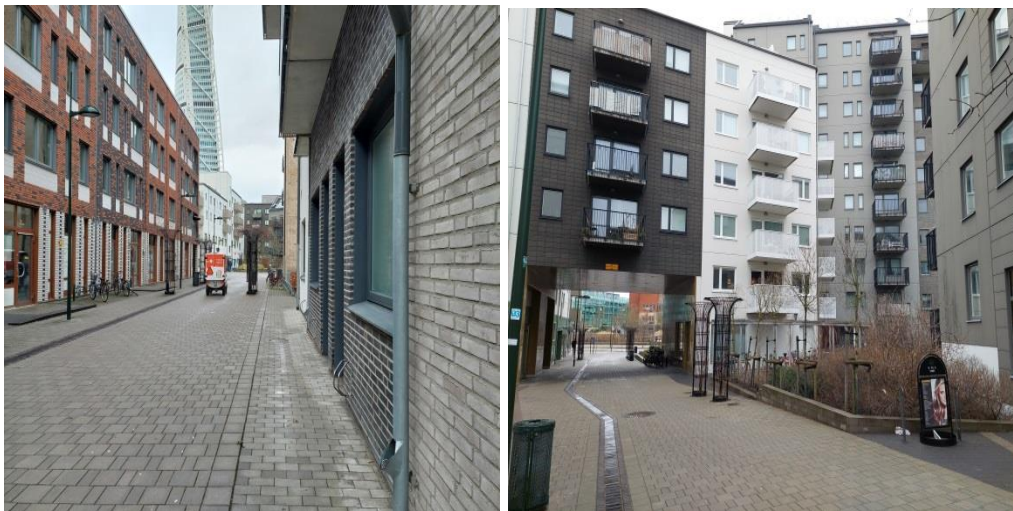


Figure 3. Picture of street from Masttorget, by Author Figure 4. Picture of Mastgränd, photo by Author.

Maybe it is the visual sense, our strongest sense, which captures something reflecting on your emotions? If you see at some of the pictures you can see that the newly developed buildings and streetscapes are quite strict in their



appearance, their lines are uninterrupted, often flat, the street levels are uninteresting and the colour scheme is often greyish.

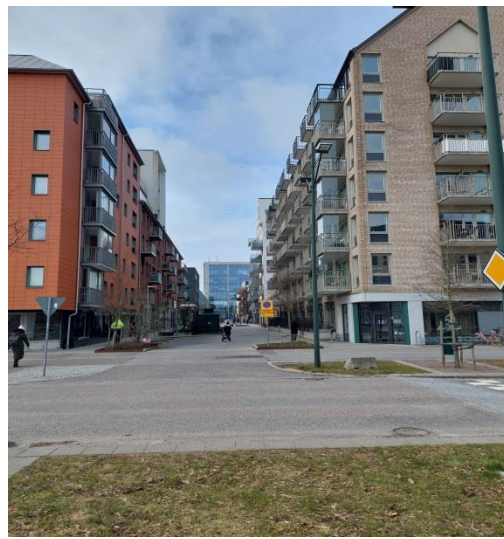


Figure 5. From Masttorget facing southward, by author Figure 6. Looking westward towards Masttorget, Photo by author.

I was also doing a walk in a new development a bit further to the west in Malmö on the other side of Limhamnsfälten. This development is going under the name Limhamns Sjöstad. Something I noticed when taking some photos was that on two different streets the width of the street from house to house was only, 5 meters. Bear in mind, not pavement to pavement, but house wall to house wall. This is quite a narrow street, especially when the houses can be quite high maybe up to 6 floors high. The risk seems to be high that we can have dark environments that are imposing themselves on the pedestrians and the residents living in the lower floors. This is not giving city planners much option when thinking about the street level and how to make them interesting and inviting, not much place for trees and other decorations.



Figure 7 and 8. Pictures from Limhamns Sjöstad, Photo By Author.



Figure 9. Picture from Limhamns Sjöstad. By Author.

To conclude my descent into the dense urban environment, I did not really develop the feeling of being overwhelmed or of being squeezed by the buildings and the city constructions but they were tight. Still I had an underlying sense of stress or rather of wanting to rush on, to leave and move to the next thing to do. This cityscape was not interesting or capturing ones interest in any way. It was a sterile place that did not invited you to stay or do something.

Comparing the new dense city with older city centres that have grown up some centuries ago it is possible to see a difference in how we perceive these city districts. In the pictures below from the old city Gamla Stan in Stockholm and from the western part of the old city of Malmö, going under the name of Gamla Väster, some interesting differences in appearance is detected. First of all there are almost no straight lines at the street levels of these older districts. Both the streets and the houses themselves are dwindling and there are curvatures, making you interested in what is around the next corner. Even when the street is straight as at the picture of Gamla Väster the roof tops and structure of the buildings are changing and they are varied. The green vegetation also aid in getting the non-linear structure an interesting character in this streetscape. There is what Browning calls mystery (Browning et al 2014) and what Kellert terms as placed-based relationships and evolved human-nature relationships (Hidalgo 2014, and Kellert 2008). This kind of streetviews creates a want to explore and of being restored by soft fascination (Kaplan & Kaplan 1998).

There are detectable differences in the colour-scheme of the newly developed city-districts compared to the older ones. As known to us colours are of importance when it comes to our experience of our surrounding environment and on how we perceive emotions and sense of calm and relaxation (Paraskevopoulou et al 2018, Neale et al 2021 and Rene-Clark 2021).





Figure 10 and 11, Gamla Stan in Stockholm, from Google Pinterest 2019 and Reseguiden 2013.

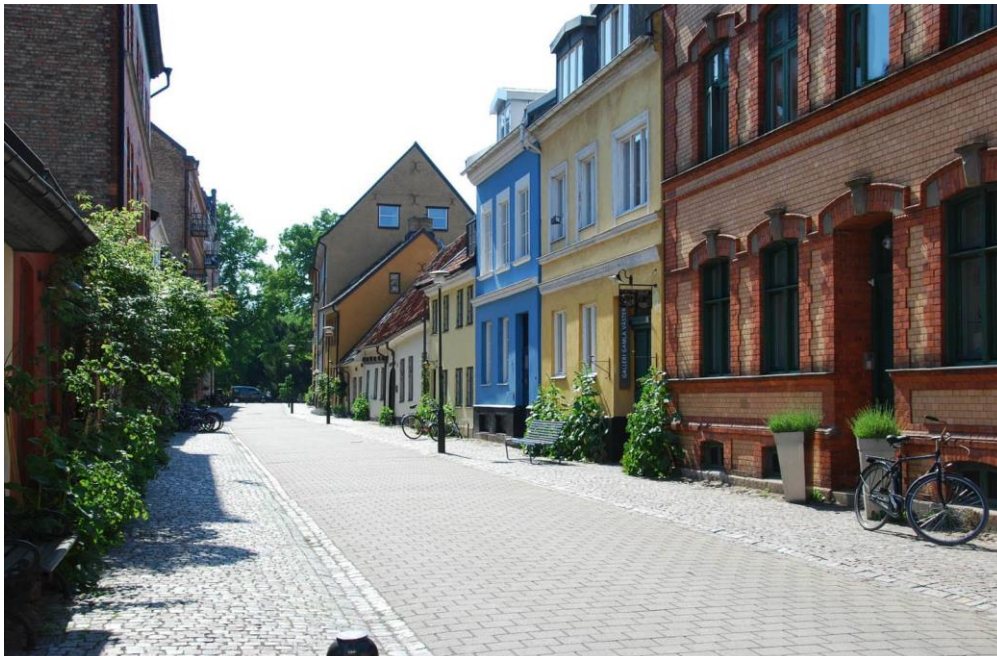


Figure 12. Picture of Gamla Väster in Malmö. Photo from Google by unknown.

Below are some visual examples of a street inspired by biophilic city design for us to study. What is a biophilic street? It is shortly a people-centred place, designed to encourage and facilitate optional activities, a sense of community and other social functions (Cabanek et al 2020, Browning et al 2014, p 16-17). If we compare the photos below with the older street views from figure 10 through 12, we can see that the biophilic design in the street level has an effect of distorting the straight lines, adding colours and creating a more living neighbourhood. A neighbourhood worthy of exploration. The biophilic green street creates interest from the general public passing by, promoting and inspiring social interaction and connections. There are with certainty similarities with the older city centres shown above.





Figure 13. Example of Biophilic street design from Paris. Photo by Edge



Figure 14. Green wall at Musée du quai Branly, Paris. By Edge.

Below are some visionary ideas of biophilic design from Mexico on how to renew large avenues, making them more people friendly. The same principles are at play in this design on how to make the streetscape more inviting to human social interaction, capturing interest and inviting you to stay and take some rest.





Figure 15 and 16. Reshaping streets into cultural green corridors. By archdaily.com

Malmö also has its renewal of the streetscape with several large projects to rebuild the city and its streets in a biophilic direction. An example would be the renewal of Regementsgatan that is ongoing as we speak. Below we can see some pictures from Neptunigatan in the West Harbour of Malmö. Neptunigatan is a street inspired by biophilic design with separation between cars and cyclists. Moreover it has a water drainage system with green water beds to handle heavy rain fall.



Figure 17 and 18. Neptunigatan Malmö, biophilic street with storm water management and separation between cars and other users. Photo by Edge 2019.

These are interesting features on how to construct resilient cities with biophilic design and how to build streets that are people focused and promote social interaction instead of fast traffic flows (Cabanek et al 2020, Browning et al 2014, p16-17). Agata Cabanek and others are, in their interesting article, describing biophilic design functions built in to the streets to prevent some of the effects of climate change (Cabanek et al 2020), these protection can also be accomplished with green infrastructures such as urban forestry and micro-forest as we shortly will be looking at, but first I want to compare our impressions from the newly built city with the older city centres from the pictures above.

What differences can be detected comparing the modern dense city with the older dense city? There can be several reasons why we perceived the streetscape differently. From our descent in a modern dense city compared to an old dense urban landscape. Maybe one of the perceived sensory dimensions discussed by Patrik Grahn and other scientists is at work, namely the cultural dimension. A dimension giving us a sense of our antecedents and history (Grahn et al 2010, Grahn & Stigsdotter 2010 and Stoltz & Grahn 2021, Scopelliti et al 2019), that affect our views and often steer our affections in a positive direction, calming our senses (Grahn & Stigsdotter 2010, p 270) and affecting our sense of belonging, putting our existence in some sort of context and meaning (Lewicka 2011, Stigsdotter & Grahn 2002 and Subiza-Pérez et al 2020).

Another concept could be the connection to nature that is detectable if we are looking and comparing the pictures above. If we are looking at figures 3 to 6 we see a colour-scheme (Rene-Clark 2021, Neale et al 2021, and Paraskevopoulo et al 2018) that is greyish and brownish, that in combination with other factors give us a dull, life-less impression. Furthermore we see straight lines everywhere in the modern, newly developed denser neighbourhoods of Malmö, the street it-self, the house facades, the windows, etc. In contrast at the pictures showing us the urban landscape of elderly city centres we see curved streets, a contrast rich environment at the house walls with different windows, ornaments and interesting details that could be studied as a by-passer. Allowing us some effortless attention that can aid us in restoring our senses. That is a possibility that is very beneficial to us according to the theories of attention restoration theory constructed by the Kaplan's (Kaplan & Kaplan 1989, Kaplan 1995). Furthermore looking at the curvature of the street in the old city district of Stockholm we can easily imagine what interesting experiences that may be behind the next dwindle, an interest in exploration as discussed by several scholars theorising the perceived sensory dimensions as well as supportive environment theory and the ideas of the Kaplans of fascination, mystery and prospect (Kaplan & Kaplan 1989, Grahn et al 2010, Palsdottir et al 2018, Stigsdotter & Grahn 2002, Morgan 2010, and Browning et al 2014 p 48-49).

We can also see at figure 12 of Gamla Väster in Malmö, that even if this street is straight the line of vision is broken up by the roof-line that varies a lot and by the vegetation and colour-rich facades. In modern city-planning we may be missing some features that give life to a street, as a street designed with biophilic ideas does? We lack the broken up lines that nature will impose in a biophilic design, in nature there are no straight lines. We lack one of the most interesting ideas from biophilic thinking that is to mimic nature. In nature there seems to be fractal patterns that we as humans prefer and that give us a sense of visionary calmness (Taylor et al 2011). This thinking is also dominant in biophilic design (Browning et al 2014 p 38-39, Kellert & Calabrese 2015, p 18, and Beatley 2011 p 53-62). It may be so that we have a preference for a landscape, even an urban landscape that have fractal characteristic as nature has (Taylor et al 2011, Hidalgo 2014, and Hägerhäll 2012), of a city view with natural light, a colour-scheme that is soothing, fewer straight lines aided by greenery and trees (Hidalgo 2014, Wijesooriya et al 2023, Browning et al 2014). A variation that is good for our mental health (Gunnarson & Hedblom 2023, Milliken et al 2023 p 176-177, Hung & Chang 2021, p7, Hartig et al 2014).



As we have seen in our investigation of the dense city nature-like design elements are beneficial to our senses in an urban landscape. We have also seen from the modern dense city that it is hard to build in nature in a city landscape. Maybe it is more efficient to build small green areas suitable for human beings. Such a place are the micro-forest and especially the hybrid micro-forest.

We will now continue to study the concept of urban nature, urban forestry and specifically the concept of micro-forests by immersion into a hybrid micro-forest and a look at two coming creations of micro-forests in Malmö.

## 2.3 Micro-Forests and Hybrid Micro-Forests

Urban forestry and micro-forests are becoming more interesting as a part of the growing interest for biophilic urbanism and biodiversity within city limits but also as a concept to quickly afforest a landscape. Micro-forests are a Japanese concept on how to quickly plant and grow a tiny forest within an area as small as a tennis-court. The Miyawaki-concept of micro-forests are of interest, because according to the concept, you could grow a forest-like environment in as short time as 10 years within very small areas, which is good in an urban context. It should also be self-contained after three years requiring no further maintenance. Some of the characteristics of a micro-forest is that it is a very dense plantation and varied in species. The concept promotes urban biodiversity with the design idea that the dense hedged borders of the micro-forest contains plant-life with flowers and berries, attractive to insects, pollinators and birds. It should also be interesting in urban planning because of climate change concerns. A micro-forest is a good tool for mitigating storm water drainage and the well-known heat islands effects and dryer climate that is created within urbanizations. A micro-forest also has a role to play combatting air pollution from harmful residues and to function as a carbon trap (Lewis 2022, Rötzer et al 2023, Kowarik 2018, and Relf & Lohr 2003). Furthermore and of particular interest to us, the concept can promote community engagement and strengthening of place bonding within the neighborhood that the micro-forest are supposed to be planted. It is so because it is thought of being planted by local residents and volunteers (Lewis 2022, Robinson 2021, Cardenas et al 2022), having the same effects as a therapy garden (Palsdottir 2014, 2018 and 2021 Bengtsson and Grahn 2014, Stigsdotter & Grahn 2002).

The hybrid micro-forest, the most interesting formation in this investigation could be defined as a classical micro-forest with extensions in functionality and in its design. The hybrid micro-forest can be designed for specific target like pre-school students but more general its structure is developed beyond the Miyawaki micro-forest with an area designated for gatherings, quite open and another area that is more forest-like, but not as dense as the hedged original micro-forest. This area should be a designated playground, a playground for creative play and teamwork with loose natural materials, with stock and large boulder to climb on and hedges to hide in, etc. The hybrid micro-forest should be divided in different rooms for different purposes, for social interaction and for withdrawal and restoration (Owens 2022, Nebelong 2008, Mårtensson et al 2021, Palsdottir 2018, and Grahn et al 2010). In many ways it is structured as a rehab garden or a healing garden (Grahn et al 2010, Palsdottir 2021, and Stigsdotter et al 2011). This hybrid

micro-forest is much more a place for outdoor activity and social interaction with benefits associated to that kind of human endeavours than the classical micro-forest associated benefits, such as increased biodiversity and functions to mitigate effects from climate change, even though the hybrid micro-forest also has this functionality..

Special attention will be taken in the further study to investigate if and how micro-forest and urban forestry are on the agenda and how benefits and ecosystem services from this sort of green infrastructure are valued in comparison to other possibilities. When we consider how these green features are introduced into a city environment it is of value for us to know that Stoltz & Grahn in a recent study has done an interesting development of the combinations in the eight dimensions of the PSD-theory (Stoltz & Grahn 2021). In a somewhat modified terminology they proliferate a combination of Natural (Wilderness), Shelter (Safe Haven) and Diverse (Biodiversity) as a preferred restorative environment (Stoltz & Grahn 2021, p 5). They are also pointing out that you most often need large areas to perceive naturalness in a landscape, but also mentions that features such as old trees, natural boulders, etc. can provide the quality of naturalness in much smaller areas (Stoltz & Grahn 2021, p5). This is as we will see especially interesting when we look at concepts such as micro-forests and hybrid micro-forests.

Much of the benefits of urban forestation and micro-forests are that they create wilderness/naturalness or increased biodiversity in urban landscapes, that has a multitude of positive effects such as creating restorative environments (Yin et al 2023, Scartazza et al 2020, Sonntag-Öström et al 2014, Stoltz et al 2016, Danford et al 2018, and Kowarik 2018). Following such an increased biodiversity from new plantation of micro-forests with more plant and animal life we will probably see effects on human health and well-being (Yin et al 2023). The forest are also efficiently combating effects of climate change and urbanization, such as heat islands (Rötzer et al 2023, Beatley 2024 Ch. 1, and Konijnendijk & Randrup 2004). Another effect important for urban environments that we will look more into later on, is that the planning and constructing of urban micro-forest are supposed to be implemented by local volunteers, an aspect that could raise local engagement and place attachment for the local community (Robinson 2021, Lewis 2022, Cardenas et al 2022, and Elmquist et al 2015 p 105, Beatley, 2016 p145), thereby creating community bonding.

Trees has a large impact on factors such as mitigating climate effects by foliage coverage, combating air pollution by carbon uptake, increasing and protecting biodiversity and by functioning as a recreational and restoring environment for humans (Beatley 2024, Rötzer 2023). Micro-forests are of specific interest in the urban landscape since they serve all these functions, they grow with exceptional quickness, they don't take up much space in a dense urban landscape and they invite residents to engagement and activities of which both are good for human health and well-being (Miyawaki, 1998. 1999, 2004, Cardenas et al 2022, Yin et al 2023, Yu & Hsieh 2020, and Oh 2020).

### 2.3.1 The Micro-Forest

Micro-forests are a concept developed by the Japanese ecologist/biologist Akira Miyawaki to accomplish fast afforestation of an area that could be as small as a tennis-court. Akira has used it to reforest depleted land on a large amount of places in Asia (Japan and Malaysia, etc.). Proponents of this method point to some advantages, for example that it has a very rapid growth speed, that it after the first 3 years are supposedly self-sustaining and maintenance-free, that it promote biodiversity and wildlife (Lewis H, 2020 and 2022) and that it in its implementation promote community engagement and community bonding as we said above (Cardenas et al 2022). Miyawaki himself also points towards cooperation with private partners such as large companies that finance and provide land to the plantations of micro-forests (Miyawaki 1998, 1999 and 2004). This is an interesting concept of a public-private partnership and cooperation where municipalities, property companies (and other companies, with industrial lots, etc.), non-profit organizations and local residents can work together to quickly accomplish a greener city.

What is so special about a micro-forest? Normally a forest, urban or not, is developing over a long time on a large area. The development and growth of vegetation and a forest has a natural succession, with plants following a natural order. The succession is a change of plant species over time in different phases, where at the three first phases the place is colonized by one and two year grasses, later pioneer species take over. These are adapted to open exposed places, fast growing and competitive. Finally the place is colonized by secondary species that thrive in the shadows of the pioneer species (Sjöman & Slagstedt 2015). This process of change and development could take hundreds of years to reach a fully grown forest. In a changing, fast developing urban landscape it would be difficult to see this slow succession of a forest developing on large patches of expensive land, land that could be exploited by new buildings and urbanizations (Miyawaki 1998, 1999, 2004, and Lewis 2020).

What are the main characteristics of a micro-forest and how can this be of value in urban landscapes? Some of the main features of a micro-forest of Miyawaki-type are (Miyawaki 1998,1999, 2004, Lewis 2020, 2022, and Egerer & Suda 2023):

- That it is fast-growing.
- It could be as small as around 200-250 square meters.
- It is densely planted.
- It should be enclosed. The enclosure could be dense flower bearing bushes inviting insects, bees and birds making the forest more biodiverse.
- When planting you should be particular about the quality of the soil.
- It should be native species if possible.
- It should be a diverse mix of species on the dense plantation.
- The plantation should still contain four layers; a bush layer, a lower tree layer, a tree level and finally an upper tree layer giving a canopy to the grove.

- After 1-3 years of intensive maintenance the micro-forest will be self-maintaining and no further human care is necessary.

This Miyawaki-forest is according to its proponents extremely fast-growing due to its dense structure and large variation of native vegetation, at least 30 different plants is recommended, and therefore it should be able to create a fully biodiverse forest as fast as 20-30 years instead of the around 200 years it could take to grow a traditional forest (Miyawaki 1999, p 24, Miyawaki 2004, p 87, Lewis 2022). Proponents of micro-forests support the concept that this way to build or create a micro-forest makes it grow ten times faster, that it is or should be thirty times denser and that it is one hundred times more biodiverse than a normal tree plantation (Miyawaki 1999, and Miyawaki 2004, p 85 Lewis 2020). It is pointed out that its upbringing is one hundred percent organic as well (Cardenas et al 2022, p 29; Lewis 2022, p 8-20, Egerer & Suda 2023). Sceptics or critical voices naturally mentions that these figures come from climate zones that are not temperate but rather tropical with much longer growth seasons and a lot more rain than in most temperate zones, Miyawaki is bringing this up himself (Miyawaki 1999, p 24) and we can also see the effects of micro-forests plantations in the Netherlands, England and Scotland (Cardenas et al 2022). Which maybe could put the concerns aside?

But even if such interesting figures should be taken cautiously it can for certain be said that the interest for micro-forest are growing in Europe and the US (Lewis 2020, Buckley 2023, Hewitt 2021) with some large private companies and/or organisations, such as SUGI, EarthWatch Europe and IVN Nature Education, pushing the issue, planting micro-forests around Europe and other places in the world (Cardenas et al 2022) with what it seems good results. Several of these organizations are developing interesting measurements of the effects from these planted micro-forests. The University of Maastricht is doing this for IVN Nature Education. Especially the measurements done by EarthWatch Europe in the UK are in the forefront. EarthWatch are measuring several ecological and social benefits from plantation of every micro-forest they are doing. They measure environmental benefits such as, carbon captures on how much carbon the plantation is capturing during its growth phase and forward, they measure storm water management to see how the plantation handles flooding, thermal comfort to measure changes in temperature to get information on heat island effects and finally they measure biodiversity. EarthWatch are also considering factors influencing these measurements such as the age of the forest, composition of species, forest design and multiple geographical data (Cardenas et al, 2022 p33). By questionnaires they are also measuring social benefits of planting micro-forests by looking how it is fostering connection to nature and potential well-being of participants and local residents. This information is available at the tiny forest portal and could be used to promote implementation of micro-forests locally in Sweden. Measurements like this are important, since as we all know a good and well-done cost/benefit analysis (Song Ping Xiao et al 2018, Ryan et al 2023, and Cardenas et al 2022) is always a positive promotor when one wants to introduce something new as the concept of micro-forest.

Even if we should take a sceptical position and calculate lesser growth rates of a micro-forest in our Nordic climate, one important benefit still exists. A benefit

that in itself motivates plantation of micro-forest in urban landscapes. That is the community engagement that could start by the plantation and initial maintenance of a micro-forest. One main characteristics of the micro-forest is as mentioned before that it should involve the work and engagement of volunteers and the local community, this is emphasized by Miyawaki himself, by strong proponents of the concept as Hannah Lewis, by Edwina Robinson in Australia and by the organizations driving the plantation of micro-forest in Europe and around the world as The SUGI-project, EarthWatch Europe and IVN (Miyawaki 1998, 1999, 2004, Lewis 2020, 2022, Robinson 2021, and Cardenas et al 2022).

Place attachment is a well-established research area looking at how and why you are connecting a place with feelings of belonging and even identify yourself with the place (Scannell & Gifford 2010, 2013, 2017a, 2017b, Lewicka 2011, and Manzo 2003). Place attachment often follows from local engagement, with activity and working together as a group follows engagement and teamwork. A feeling of responsibility is developing. As well as connection to a place and of the members in the group (Oh et al, 2020, Perkins 2018). This is not a bad thing in a large metropolitan area where anonymity and “it-is someone-else-problem” attitudes often are norm instead of exception. The role that activity and engagement in local community has, becomes even more important in a fast changing, developing city, since much of the identity and attachment to place is established during childhood and young adulthood, when you are playing, growing up and learning to know a place, a city block and a town thoroughly. If this changes to fast so that your landmarks and the places you remember disappears then so does your identity with and feelings for a place (Bartos 2013, Lewicka 2013, and Thompson-Fullilove 2013). Therefore are micro-forests and hybrid micro-forests fostering activity and creating community bonding so important in a modern fast changing city.

### 2.3.2 The Hybrid Micro-Forest

The hybrid micro-forest characteristics differ somewhat from the pure Miyawaki micro-forest but the affordances it offers to society are higher. A hybrid micro-forest would probably have the diverse, densely planted forest as a core but will also have a more open area, an assembly area where you could meet up in group, maybe with possibilities to have a fire. It should also have a dynamic transition towards the evermore densely forested are. This place should have boulders, logs and loose materials suitable for creative play. It is a playground for self-attained unsupervised play or exploration. The last part in this hybrid micro-forest will be the dense, hedged biodiverse forest. This kind of three-folded micro-forest is interestingly described by Owens (2022). The three basic building blocks of a hybrid micro-forest will greatly expand the possibilities on where to build them in an urban landscape by its higher usability and its better cost/benefit ratio. Places like this increases the biodiversity of the urban landscapes, it provides protection to climate change, it provides natural creative playgrounds for adults and children, it increases children’s exposure towards nature and opens up for outdoors education. The place invites pre-school students to teamwork and when created it promotes social interaction and local engagement. The hybrid micro-forest has in some ways an resemblances with a healing garden or a therapeutically garden

described by scholars such as Grahn et al (2010) and Stigsdotter & Grahn (2002). They are separated in several rooms for different purposes and to meet people's different needs.

A micro-forest has a potentially large role to build place attachment for the neighbourhood and a natural connection to nature for city-living children as a playground and place of eco-education in pre-schools and schools. Hybrid micro-forests can have that potential role since children's basic attachment to place and feelings for nature seems to develop through, the very interesting prospect-refuge theory. This theory describes how children evolve their relations between themselves and their environment in a circle of being excited, running out exploring then becoming tired or afraid going back towards some figure of attachment (could be a parent or teacher, or maybe a safe place) and this process continues in a loop (Morgan 2010 fig 1 p15). I want to emphasize that children loves messy, creative places where they can explore in relative safety, working together and not being overseen by adults all the time (Nebelong 2008, Bartos 2013, Morgan 2010 and Oh et al 2020, Yu & Hsieh 2020).

The hybrid forest is diverse, natural and sheltered with trees and dense, varied vegetation, it can and should be divided into different rooms much like a rehab garden or healing garden described by Grahn et al (2010) and it therefore contain the prospect-refuge dynamics mentioned by Appleton (1975), by Grahn et al (2010) and by Stoltz & Grahn (2021). A dynamic suitable for kids and pre-school students in there development discussed by Morgan (2010). If you look at the discussion in Stoltz & Grahn (2021) you can see that the dimensions are strengthening each other. (Natural, Sheltered and Diverse) are enforcing each other's and stand in contrast to (Open and Social) which in turn enforces themselves.

One of the main benefits for promoting plantation of micro-forests are that the activities of plantation and maintenance performed by local residents, pre-school students or other volunteers raises the engagement for the local community, the engagement in and responsibility of the place, and of society in general. The community bonding that such activities could create are important when we talk about possible resistance from authorities and their administrations on subjects such as maintenance and the cost/benefit calculus of planting new trees and forests in the urban landscape (Song Ping Xiao 2018, Ryan et al 2023, Cardenas et al 2022, and Robinson 2021).

### 2.3.3 Potential Benefits from Micro-Forests and Hybrid Micro-Forests

As we have seen urban forestry and especially micro-forests, since they are growing so fast, are concepts that quickly can increase biodiversity, mitigate the effects of climate change and build community belonging and engagement in the local community. Hybrid micro-forests and urban forests can be used to promote health therapeutics and eco-educational fostering of children and adults by involving them in the plantation and maintenance, by having sessions such as forest bathing and nature experiences in them and by letting pre-schools use them for educational purposes and children using them as creative and messy playgrounds (Zhou et al 2019, Nebelong 2008, Mårtensson et al 2021, Yu &

Hsieh 2020, Pedretti-Burlis 2007 and Oh et al 2020). Other benefits of micro-forests are their role for biodiversity. Even though large, old trees are special in promoting biodiversity, so is micro-forest if they are done correctly. A Miyawaki-style micro-forest should be planted with an enclosed hedge as a barrier between the forest and the surrounding environment, a bushy barrier of flower and berry-rich vegetation attracting bees, insects, birds and other wildlife to the micro-forest and at the same time this barrier functions as an eye-catching, colourful and green oasis for people passing by (Robinson 2021, Lewis 2022). An urban micro-forest reduces air pollution through carbon capture. Trees and especially large trees have a disproportionately large absorption of carbon as well as a heat reducing effect through its canopy coverage as well as being a home for a rich biotope of biodiversity (Beatley 2024, Ch. 1). Large trees in all honour, but to get fast results in an urban environment city planners should consider working with micro-forest since they grew so fast, making an impact faster. One of the most important benefits in an urban landscape is that micro-forests mitigate climate change effects by storm water management and reducing heat island effects through a larger green coverage in cities (Lewis 2022, Rötzer 2023, Kowarik 2018, and Konijnendijk 2021). Finally they make people healthier and increase their well-being through promoting activities and social interaction, by being places to restore and recreate in, but also to function as a green, flower-rich, colourful wall, with insects, pollinators, bees, birds and butterflies being aesthetically beautiful.

We will now continue to insert ourselves in one of the only existing hybrid micro-forest like environments in Malmö that is urban in its location, even though it is more like a park in its construction than a forest. You can of course include the 2-3 outdoors pre-schools that exists in Malmö, which supposedly would be in a natural forest-like environment much like a hybrid micro-forest. But that would be another study. Later in chapter 2.3.7 we will use an outdoor pre-school facility to exemplify the benefits possible from a hybrid micro-forest like environment. Malmö have micro-forests in a planning stage and we have the Millennium-forest that is much more like a mixed, varied micro-forest in its construction, but the Millennium-forest is located on the very edge of Malmö in a rural landscape. Therefore I think a visit to Ankarparken hopefully will give us valuable knowledge.

### 2.3.4 Ankarparken: A Hybrid Micro-Forest?

The reason why I have chosen Ankarparken is that this particular park is what is called a “hydro-glyph”, a park or nature area where different types of nature are seamlessly forged together (Malmö stad 2024, Ankarparken). The park is one of the green spaces most like a hybrid micro-forest that for the moment exists in Malmö city centre and therefore I want to get some actual impressions from an area looking like a micro-forest and that is created with the intention to build small patches of forest tightly together. This park is according to Malmö Stad an eco-system of its own created since there is not much “real” nature in Malmö.

Within this park there are groves of forests, a boreal forest of pine trees, an alder marsh, an oak grove and finally a beech grove. The water in the small channel, with a shore-line curvature to mimic a natural coast-line, flowing through the park on the left-hand side of the pictures below is salt water from Öresund (the

sea, in the background). The original vision of the park was to create a feeling for the visitors of entering different kind of Swedish nature and also to encounter material, such as iron, stone and concrete, that you normally meet when you are in old harbours or cities by the sea. This park is also meant to function as a place of environmental education and pedagogy (Malmö stad 2024, Ankarparken). This thinking connects a lot to the dimension of cultural, described by Stoltz and Grahn 2021 and Grahn et al 2010) and by Tveit & Ode-Sang (2014) concept of historicity, which describes how our landscapes are perceived by the visitors as connected to what people before them has done, that gives the visitors a connection and feelings of belonging and meaning.

To function as a place for creative play, nature experiences and eco-education is one of the more important aspects of a hybrid micro-forest, this gives this specific park a reason to be in our study, its construction will also give us some interesting clues to what perceived sensory dimensions that are of specific interest in the urban landscape. Is it a restorative dimension or maybe instorative, more activating dimension that people need or want?



Figure 19. Oversight of Ankarparken and its channel. Photo by Bjurfors 2018.

A sunny and windy Monday afternoon the 4:th of March 2024 around 14.30 I visited Ankarparken to get some impressions on the environment in this green infrastructure, constructed to the large city development and living fair of 2001 (Bo 01). The sun is warming my face when entering the park despite the somewhat cold wind from northeast, so it is the very first feeling of a possible spring that you as a visitor experience this day when it is around 8-10 degrees. I was entering the park from the south and the first I encounter is an abandoned closed parking lot with a small pine grove on the right. Maybe this parking lot is a homage to the industrial history of this specific place where the former car-maker SAAB should have been producing and parking its cars.





Figure 20 and 21 Abandoned parking lot and entrance through the pine forest. Photo by author.

I am spending approximately 50 minutes in the park, sitting down on some of the benches close to the curved shore-line by the channel, walking around, feeling, listening, taking some photos and talking to people. My over-all impression is that of an open park, an open vista, calm with places to rest and for social interaction. It is a place with interesting features to explore and see; there's water, curved pathways, the small forest groves, birds and so on. To use the vocabulary of Patrick Grahn and others of the Perceived Sensory Dimension I would describe the park as a place for Prospect, Social and maybe also with Space (Grahn et al 2010, Stoltz & Grahn 2021) or if you want to use the Terminology of Tveit and Ode Sang, a place with Visual Scale, Coherence and Historicity (Tveit & Ode Sang 2014). To conclude I would say that I get a very positive feeling when entering and staying for a while in this park. But now I think we should go back and look on some details from my immersion into this urban green landscape.

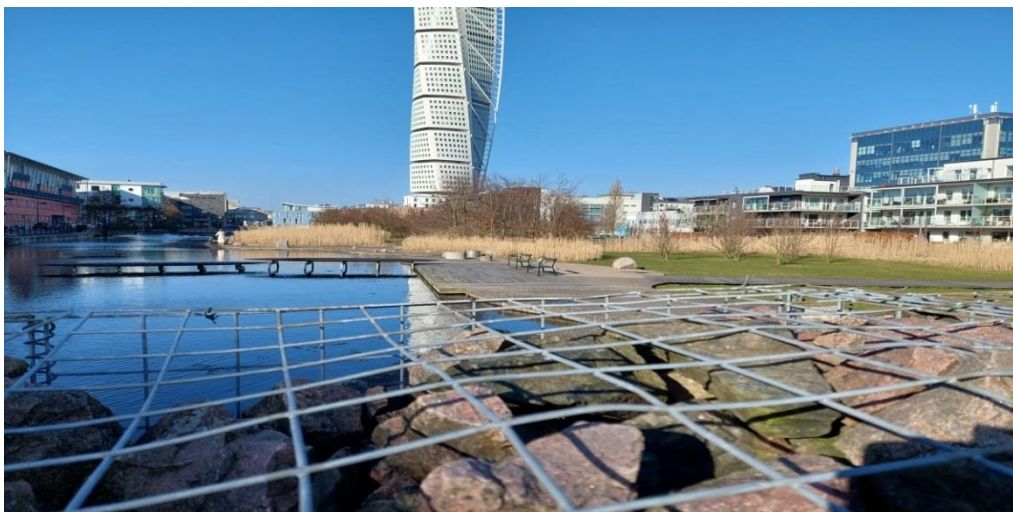


Figure 22. Open vistas with touches of the past as an industrial harbour. Photo by author.



Figure 23. By the sea-side, seating possibilities perfect for taking a break. Photo by author.

When I first entered the park from the south it was an open curved landscape with small forest groves and a blue sky that meet me. I saw the pier-like, gentle pathway along the channel with plenty of sitting opportunities and park-benches covered and protected by reed ridges giving you a pleasant sound backdrop that somewhat took you too the real sea-side. I sat down on one of the benches and lifted my face in the sun, closing my eyes, listening to the sounds of this park. Of course the background was filled with noise from the city but not overwhelmingly. I could hear the wind since it was a very windy day; the nearby reed was also giving you an impression of being in nature accompanied by the sound of water from a small water-fall on my left. In the sky I heard sea gulls and on the water there where ducks taking off into the air. This is a place possible to take a break in. One of the features making you feel comfortable and in nature might be the visual impression you get from the park. There are not many straight lines anywhere, the park is bending and there are curves in pathways and shore-line and forest groves.



Figure 24 and 25 A park built with curves. Photo by Author.





*Figure 26. There are no straight lines in nature. Photo by author.*

Being in the park for a while I would say that this is a very well visited place, being in the afternoon an ordinary Monday. I encounter people passing by, a lot of dog walkers with their dogs, moms and dads with their small ones in a stroller or playing and feeding the ducks and swans in the channel. Yet you do not feel overcrowded since there are a multitude of different pathways and small pockets of nature to be in making you as a visitor feel that you control who to meet.

I had a conversation with one of the dog walkers, a little old lady, asking her what she felt about this park and if she was in this place often. She replied that yes, she was there a couple of times a day and her first thought of how she perceived the park and its forests groves was that she felt they were a bit messy with all the lose branches and dense vegetation. This commentary will be interesting later, since I had the great fortune to see and meet a very large group of pre-school kids with their teachers a few minutes later.



Figure 27. Free play and eco-education at the same time. Photo by author. The picture is taken with consent of the teachers with the understanding that the pre-school kids are not identifiable.

An interesting hybridization of the original Miyawaki-method is described in the paper of Molly Owen (2022), The micro-forest concept is deconstructed into a forest grove with different functions the original nature part, the children's play – ground, less dense than the original part but still messy with stuff for children to play and build with, making their own paths in the grove and lastly a part for social interaction a meeting place between the forest and the city, a place for education and social interaction.

A construction of a micro-forest of this character could be interesting to build in school-yards and day-care centres, in between buildings to create community engagement. This kind of utilization of micro-forests would aid in the calculation of implementing them into the urban landscape especially if we look at research on children's play and their development of self-esteem and creativity (Morgan 2010, Nebelong 2008, Mårtensson et al 2021, Oh et al 2020, and Yu & Hsieh 2020).

There is an interesting description of our complex desire for the possibilities of refuge vs prospect and how this desire develops during childhood and at the same time is connecting us to place in an article by Paul Morgan (Morgan 2010, p 15). In other words the article is describing our conflicting search for security vs exploration, the dilemma that every design of a place meets, the dilemma of being attractive and filled with activities to lure us in to visit it and at the same time be a place suited for our the search for a protected haven, a resting place, a place of tranquillity in our busy lives.





Figure 28 and 29. How children want to play. Photo from location outside of Malmö By author.



Figure 30. This is often what a modern playground looks like in Sweden. Photo from Hjo municipality 2022.

As I mentioned I meet a large day-care/pre-school group from a nearby school just a few hundred meters away when they entered the park. Naturally, I got curious and went to talk to the teachers about their visit. I learnt that they, the school, visited this park every day with some groups and that the teacher I spoke with visited the park at least once a week with her classes. The kids of course loved to run around playing with the material in the forest groves, inviting them to creative play and exploration. The teacher also said that they when the weather permits often take rakes with them looking for small fishes and krill that they find under the walking-bridges passing the channel. I also asked, since Malmö stad on its web-site says that this is an eco-educational park, if they had any cooperation with other parts of the city such as biologists or so, They did not. Any-way the park functions as a spontaneous eco-educational park since the children spend time in nature-like environments, playing with lose materials creating their own things and interact with living animals in the water-front. As the teacher is emphasizing this is city kids not very familiar with nature. They are as I should point out also guided by engaged teachers and as in the case with the teacher I spoke with a trained biologist.





Figure 31 and 32. Ankarparken a playground for children, photo by Author



Figure 33. You play with what you find. Boulders and natural material are plentiful. Photo by author.

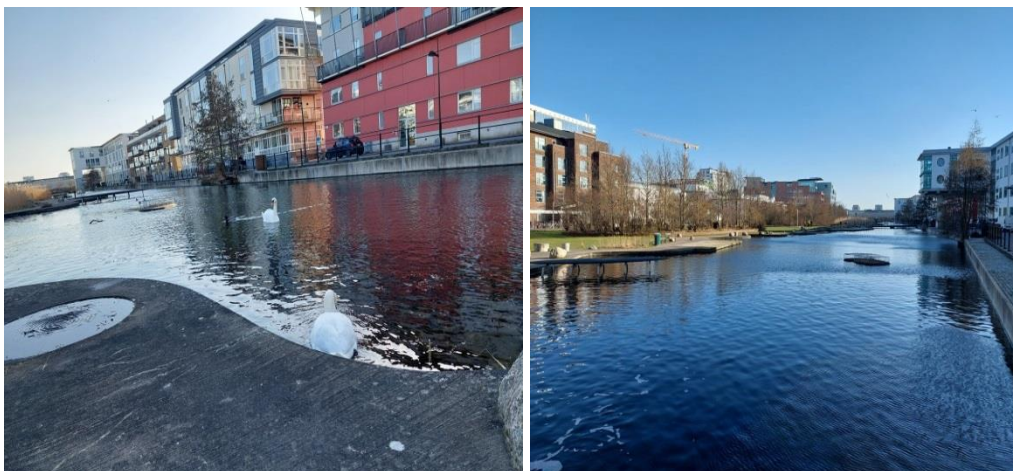


Figure 34 and 35. The children can look for small fish and krill maybe feeding the ducks and swans, Photo by author.

This hybrid park/micro-forest is really a park of variation, variation in material and in landscape. A place that invokes interest and a will to stay. The park makes the most of its history as an old industrial harbour and a shipyard. As you clearly



can get a hint about in the photo below, where you see different materials such as wood, concrete, metal and the water with its shore-line.

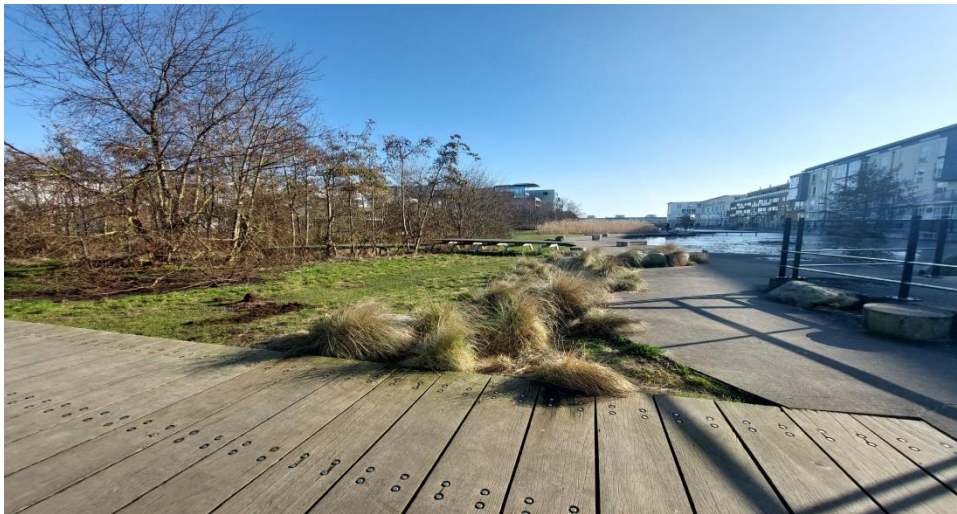


Figure 36. A park true to its history. A shore-line park with hints to its history as an industrial harbour. Photo by author.

Ankarparken was a very interesting case study giving an impression on how a small place and small groves of forests really can make a difference on many levels in a dense city. I even encountered the dilemma or different point of views that can occur when different interests meet in an urban context and on small urban spaces, making interests clash. A problem with micro-forest is that they can be perceived as “messy” and too dense to be aesthetically interesting (Söderlund & Newman 2022, p 8, Stoltz & Grahn 2021, p 2-3). It seems that people often appreciate nature that they perceive as somewhat “orderly” and as carrying the influence of humans (de la Fuente de Val 2023, p 2, Grahn et al 2010, p 139-148).



Figure 37 and 38, Messy or not, it's in the eye of the beholder. Photos by author.

In Ankarparken there is no information in the park, about the park. The visitors don't know why the vegetation is dense and there are loose branches etc. One very important factor in developing new things is to inform the public on reasons to why the place looks as it does or why something is done, then you often get acceptance. This is an important point for later in this chapter where we will look more deeply into the practise and concept of micro-forests.

### *Survey Ankarparken*

The results from the questionnaire and from comments made when distributing them in the park and from comments made in the online Facebook groups shows us that people want amenities. One father with his two small boys in the park missed toilets, others wanted more of the wild and exciting, more mystery and more possibilities to explore, exemplifying it with the bridges going through some of the groves, complaining that these bridges is ending up in nothing. So why not have some barbecue-places there, in the end. People seemed to want even more mystery, more possibilities to explore and different activities, such as an gathering around a fire, a barbeque, showing us that that what public spaces such as hybrid micro-forests are affording the public is important in the perception of the visitors and that such affordances should be based on possibilities for activities and not only restorative possibilities.

The questionnaire itself gave us some interesting answers to how people perceive Ankarparken. The description of the park was quite equal with a small majority saying they experience the park as calm, some others say sterile tightly followed by cosy. Sterile might refer to the openness of the park. That is the first impression you might get when entering the park. It might also refer to the surrounding buildings, that could be perceived as sterile in its modernity. An overwhelming majority of the respondents said they prefer the water/waterfront (88 %). A majority said when asked what they usually do in the park, that they are passing by (56 %). When answering the questions how they were feeling before and after entering the park, the majority also said they are neither calm nor stressed (52 %) before entering, but they said they were calm (60 %) afterwards, 20 % said they feel stressed before but only 4 % after spending time in the park. Regarding how often and for how long they stay in the park, the answers are some times each week (40 %) and each month (28 %) several people are there daily (24 %), and they stay for less than 10 minutes (36 %), less than 5 (28 %) and 10-20 minutes (32 %). Most people visiting the park live very close by or next-door (72 %). Of the visitors responded 64 % are women and 32 % men, with an overweight of people in the age of 30-44, otherwise the age is proportionated as a pyramid from there.

In conclusion from the survey I would say that people appreciated the waterfront the best and that they are mostly passing by, still they perceive themselves as calmer after the visit even though it is short visit, only up to 10 minutes long. This short stroll in the park seems to make them calmer and probably a bit restored in their daily life. These findings are consistent with research on green spaces and parks in urbanised areas. That they should be close by to be frequently visited, that people are not spending much time in them and that feel calmer when being in a green area (Bengtsson & Grahn 2014, Perschardt & Stigsdotter 2013, and Stigsdotter et al 2017, Sonntag-Öström et al 2014, p 351). It seems that instorative environments, with open vistas also has a calming effect after a short period of being in them.

Overall it was important for visitors that the place is close by since most visitors really lived close by, also the access to water in some form was what the visitors valued the most. People enjoyed the open vistas as well as the curvature and topography of this park that mimics nature's lack of straight lines. From our immersion we discovered that natural sounds such as the wind in the reeds and the



sound of pouring water diluted the noise of the city. The park had a restorative effect from the above mentioned but also from the possibility to choose different pathways and benches to rest on making it possible to avoid unwanted meetings. The park also opened up for creative play and activities with a lot of loose natural material, large boulders, different forest groves to explore and the possibility to look for marine life in the salt water channel. All this possibilities was making the place open for eco-education and specifically for creative play. The investigation also got an interesting lesson in how different people with different needs perceive an area differently as we saw in the perception of if the park was messy or orderly. But to conclude. Both the case study and the survey show us how important a place for nature contact and especially a natural creative playground can be for human well-being and health. We saw that people want pathways to explore, maybe to find a meeting place to gather around making a barbeque. They want loose material with stocks and boulders, dense vegetation to hide in and nature to interact with are important. The pre-school kids showed us that they start to interact and teamworking almost directly when let loose in this hybrid micro-forest like environment.

We will now be looking to some up-coming projects in Malmö where micro-forests are planned to be constructed. We will also see if we can get some information from Helsingborg on where they stand in the micro-forest subject.

### 2.3.5 Micro-Forests in Malmö and Helsingborg: Interviewing Responsible Stakeholders

#### *Malmö*

There are, to the knowledge of this author, two projects in very early planning stages on-going in Malmö. The property development company Granitor is planning for a micro-forest in a new development in the southern parts of Malmö (Hyllie). Granitor has a city block to develop within this part of Malmö, a city block they call “Embassy of sharing” (Malmö Stad 2024, Embassy of sharing, and Granitor 2024), a place where they want to create a sustainable city. Within this development they want to build a cooperative condominium by the name of “The forest grove” (Brf. Skogslunden) were they plan a micro-forest (Granitor 2024).

Hyllie is a fairly new city district development in the southern parts of Malmö. This city district has its own development plan connected to the larger planning document of Malmö. In this plan the city states that the city district of Södra Hyllie shall be “the most climate smart district of Malmö” (Malmö Stad 2019, Fördjupad översiktsplan Södra Hyllie, p 9). The plan of Brf. Skogslunden and Embassy of Sharing is connected to this ambition of Malmö. Unfortunately when talking to the sustainability officer of Granitor the project is put on hold due to the economic circumstances with high interest rates and inflation that exists in 2023-2024. I was asked to send over some questions, I sent over a couple of questions to be forwarded to the project manager but as yet I have received no answers. Therefore, without much further a due I will go to the next planned micro-forest project in Malmö known to me, that of Augustenborg.

In a phone conversation I had with a representative of the Nature Preservation Association (Naturskyddföreningen) in Malmö I learnt that they and MKB (MKB

is the real estate company of Malmö city connected to the operation of the municipality of Malmö), had a vision to create and plant a micro-forest within the district of Augustenborg. A city district well-known for functioning as a city lab for sustainable solutions (Malmö stad 2024, Eco-City Augustenborg and Månsson & Persson 2020).

The city's solutions for climate adaptation such as green roofing, storm water management, waste-disposal management and different solutions for energy management (Malmö Stad, 2024, Eco-City Augustenborg) has been introduced and tested in a real environment. The initial success of the transformation of Augustenborg was partly due to a strong political interest and of the initiative and leadership from high ranking civil servants in strategic position taking coordinative roles in the development of Malmö from old industry towards something new (Månsson & Persson 2020, p27-29, 33-34).

Later MKB, has taken the role to drive environmental innovation as a large public property owner. MKB has been testing technical innovation as well as community building activities in different projects such as urban farming (Månsson & Persson 2020, p30-31).

I interviewed the Coordinator for Outdoor Environments at MKB Augustenborg in late April regarding their intentions to start a micro-forest plantation together with external partners in the civil society. This project is interesting in several ways; firstly since the project originated by chance at a seminar with different actors. On this meeting the subject discussed drifted into micro-forests and two participants declared an interest to start the project we are now investigating. Secondly it is of interest since this project is inspired by the Miyawaki-method and its thinking but the project is also influenced by the requisite to plant a hybrid micro-forest that is taking into account the interests of local residents, their need for aesthetics, security and their possibilities to do activities in the plantation area. Finally this study has an interest in this project since it seems to have a special focus on the community building aspects and are influenced by the possibilities to use volunteers in the project.

As Elin describes, large parts of the project is about creating community bonding with the resident. The residents will pick the spot for the plantation of the micro-forest. "It will be a place for humans, we must create things they can do in this micro-forest, nice things. After all, it is outside their front-doors", as Elin puts it. In this project they have to consider conflicting interest such as perceived safety for the locals and the size and density of a micro-forest. MKB also want to create a place where pre-school students can be, resting, eating and connecting with nature. The largest scarcity and hinder for that being a reality is people and money, people with the right knowledge that can be with the children educating them and the money making that possible.

In general MKB Augustenborg and MKBs Coordinator for Outside Environments focuses on supporting native species of vegetation to support biodiversity and involving the local residents through different projects. Projects such as having plantation-days involving the resident or by the concept of self-maintenance, where residents gets reduced rents and cost coverage if they involve themselves in some improvement projects or starts home farming or other activities involving the neighbourhood. One reason for this is the perception of security or as Elin says, "It is about activities that people shall have things to do

together”, and it is about how “to create a community”. She says, that the perception of security increases if people are outside, if you see people. For now they are about to start a farming group for people to engage in and they have a group that shall do maintenance of the storm water ponds in Augustenborg.

To conclude this planned hybrid micro-forest plantation is an exciting and inspirational project that connect a strong focus on place bonding, and community building activities with an intention to create a micro-forest according to the Miyawaki-method but with accessibility making it a hybrid micro-forest. It will be a hybrid micro-forest, a place for biodiversity, a creative playground, a place for eco-education, and a community building forest plantation with all the best intentions and possibilities that micro-forest plantations opens up in an urban landscape.

### *Helsingborg*

We will now jump over to Helsingborg where there actually has been plantation and development of several micro-forests or small urban forest systems, actually as many as 17, up until now.

The city of Helsingborg has an interesting landscape with large areas of coast, and along the coast a powerful land elevation, in remembrance from the last ice age. This coastal, nature-rich land elevation from the centre of the city towards the north up to the small villages of Laröd, Hittarp and Domsten stretches out with areas of urban forests, ravines, and green corridors. According to Helsingborg’s green structure plan (Helsingborg stad 2014, green structure plan, p 1-47), Helsingborg has an, for Sweden, unusual high biodiversity, but also an unusual high number of endangered species. The landscape around Helsingborg is varied and rich in recreational eco-system services, but the biotopes are small and they need to be enlarged and increasingly coherent. Building new green corridors, as well as connecting and enlarging existing green infrastructure will be a focus according to the planning documents. This would support an increase in biodiversity and give extended possibilities for outdoors education for pre-schools and schools (Helsingborgs stad 2014, green structure plan, p 60-89).

Another for us interesting focus in Helsingborg is its experimental plantation of up to 17 micro-forests done from 2020-onwards. So apart from having quite a comprehensive green structure plan Helsingborg have had an innovative and forward looking micro-forest plantation drive. To investigate this further I had an interview with responsible landscape-architect in Helsingborg from the unit Configuration and Planning (Gestaltning & Projektering), Elias Halling. He has been a driving force to what he names a “small forest-systems near the people in the city”, these hybrid micro-forest like plantation are spread around the city with some concentration around the city districts of Mariastaden, Västra Berga and Rydebäck. One main reason for the many plantations of small forest-systems in Helsingborg is the soil quality of available land in and around Helsingborg. The plantations have mostly been made on old farm land (that has been hard-made). This is packed clay-soil that is very hard for plantation of larger trees. They will have problems to survive. The experiments of dense plantation of smaller plants 30-70 cm high have been made to circumvent this fact. Other reasons for the

plantation have been for it to function as noise protection (Rydebäck) and to build green walls for people to look at in an otherwise flat environment.



Figure 39 and 40. Example of fast growing dense hybrid plantation in Helsingborg, with information sign. Photo by Elias Halling HBG.



Figure 41 Interesting view on how to combine techniques and existing resources to create a green environment with large old trees and small fast growing plantations. Photo by Elias Halling HBG.

In the work to create these plantations, plans have been made to inform and educate locals and visitors of the long term purpose of these micro-forest as well as involving especially pre-school students nearby. Local residents and pre-schools have as well as the soil conditions been a priority in the location of these small forest-systems. It has also been important to create a visual forest-like environment quickly, a feature important for the perception of a green city and human well-being, according to Elias. Some of the ways to involve and engage the general public has been to work with pedagogic information signs and involving pre-schoolers in workshops in the plantations. There seems to be strong ambitions to involve the local residents, and to build micro-forests in locations close to pre-schools to be able to perform outdoors education. There are also knowledge in the administration of the importance of how people perceive their environment and how that relate to their perceived well-being.

One of the visions of the green infrastructure for Helsingborg is to create a resilient, sustainable city that can handle the challenges of coming climate change. This has a specific bearing on trees and micro-forest. Since urban forests and old large trees has an important role not only for biodiversity but also for a city's

canopy coverage aiding to mitigate the problems of heat island effects (Beatley 2024, Region Skåne 2023, 3-30-300 i Skåne, Konijnendijk 2021, Rötzer 2023, Kowarik 2018). As said by Elias Halling in our interview “70-80 years from now the trees we plant now will be invaluable bearers of eco-system services and they will be key biotopes in the urban landscape”, and at the same time they will have a cultural, aesthetic and recreational role to play.

If and when you want to plant variation-rich, diverse micro-forests in Sweden with the effects of climate change in mind you must consider what species to choose very carefully. In the interview it was mentioned that when planting trees you must see the plantation as a forest system, light and shadow, primary species and secondary species are the factors that is consider mostly in Helsingborg, to create a plantation rich in structure. In the design you also have to consider the fact that Sweden has very few suitable species. According to Elias we have maybe forty bush and tree species of which twenty are tree species, and considering the effects of climate change there could be even less species adapted to future changes, including connected sicknesses affecting our native trees. This is one reason why Helsingborg has started to consider and look at non-native species, something that is also mentioned in the work of Henrik Sjöman and others (Sjöman et al 2016). In the interview we talk about how very important it is for these reasons to incorporate conifers and/or specific deciduous trees that can handle dry periods. Elias mentions three native deciduous species and says that we cannot have so few trees in the urban tree population and still have resilience. “Therefore we are trying at some places throughout the city to test and see how it will develop”. This goes against the thinking of the classic Miyawaki micro-forest, but could be a necessary adaption to the reality in our part of the world. The hybrid micro-forest is also an adaption to an economic reality making the forest plantation more beneficial to more target groups in the urban landscape.

At Mariastaden we only have native species in the seven plantations there but in Rydebäck we have different themes with a mixed population of exotic and native species but this is made mostly to create structure in the plantations different layers. “We are using the term exotic species with a negative tone, they are not something negative. We have not yet learned to use them properly, that is all”, says Elias. He says that the species capturing the most carbon is Cedar, a species that we only have in botanical gardens and maybe in Malmö. These kinds of species are important for the climate and we should maybe be planting more of them, but instead we are talking about what species not to use. “Why not ask what challenges are we up against and what is the solutions to that”?

In the interview we are approaching cooperation and challenges within the work and we are talking about discrepancies between the investment budget and the maintenance budget in a municipality, where it always seems to be more money available in the investment budget, making it more difficult to maintain already done plantations in an orderly fashion. I am asking about cooperation in the organization and am told that there are an intense work done with the six persons responsible for different outdoors areas in Helsingborg, when developing new plantation it is of importance to have an excellent dialog with the people responsible for the future care and maintenance of your plantations. Otherwise the management have been given Elias a free range of responsibility as project owner



and responsible landscape architect to manage the plantation of small urban forest in Helsingborg.

Regarding cooperation with the citizens there have been the work with pre-school classes mentioned earlier and there have been plans to cooperate more with the local residents but that have for several reasons not been materialized. It is mentioned that there are a yearly event called The Children's Forest (Barnens skog) that takes place in May in different nature areas in and around Helsingborg, a nature workshop where huge plantations are being done organized by The Department of Environment (Miljöförvaltningen). Elias starts talking about forests within residential areas (kvartersskogar). Created together with the local residents living in the different areas. "That will be the next exciting thing I will do", says Elias. Here we can see an unfortunate reality that often seems to repeat itself. There are ambitions to engage citizens and the local community but due to lack of resources, lack of time, etc. This ambitions newer materialises in actual cooperation. We also have indications of that with MKB and in the interview with the administration in Malmö.

Finally it is pointed out that some of the most exciting and valuable thing with these small urban forest plantations are their ability to be changed and restructured to changing demands or changing needs. Or as Elias put it, "ten years after plantation you could go out to the citizens and ask what they want with this area, this plantation", "It is a very equal and democratic plantation".

### 2.3.6 The Millennium-Forest: Urban Forestry or Micro Forest?

This is an experimental plantation very close to heavy traffic with resemblances to a micro-forest plantation. It is dense and varied, with intriguing hedges making you interested to explore further. The hedges form smaller rooms in the forest that you just have to look into. It strengthens the Kaplan's concept of effortless attention and fascination for exploration, thereby stimulating restoration of your senses through less demands on sensory input in the Attention Restoration Theory (Kaplan & Kaplan 1989), as well as it does coincide with the concept of space, refuge and culture in the perceived sensory dimension of Patrik Grahn and others (Grahn et al 2010, Grahn & Stigsdotter 2010, and Stoltz & Grahn 2021).





Figure 42, 43, 44, 45, 46 and 47. Shows the density and variation of this forest plantation. Photo by author.

The overwhelming feeling when entering this forest is one of being in nature and into a forest. You immediately feel the smell of warm fir trees, of a coniferous forest, squirrels on the ground and a lot of intense birdsong. You are transported into another world, with mysterious hedges that you just have to investigate. This feeling of being in another world is one main description of the dimension of Space in the theory of perceived sensory dimensions and the rooms identified here remind us of the rooms in the rehab gardens described by Grahn et al (2010).

This is a special place, the forest is dense and varied in species, it is a mix of older and newer plants giving you the impression of a natural forest, a forest that has been planting itself, it gives the impression of nature and you almost forget the noise of traffic that now seems to be in a distance. When you are probing even further in to the forest, it changes character with older deciduous trees but still with the hedges, luring you further in to the forest.





Figure 48, 49, 50, and 51. A forest changing character. Photo by author.

Finally you come to a place reminding you of the Stone Age or some place of paganist worship, maybe something with a religious meaning that you know nothing about but your ancestors from times past did, giving the place meaning and mystery (Tveit & Ode-Sang 2014, Grahn et al 2010). Once again you see enclosed circles very much similar to the circle-formed hedges in the denser mixed forest, they are both promising adventure and luring you to explore further.

The effortless fascination given to you have its function to restore you, together with the nature experience you have in this still very small place. You experience a much more natural and wilder nature area than it actually is. The instorative effect from the movement and activity you get exploring further into the forest also has an effect health and well-being that goes beyond simple being in nature.



Figure 52 and 53. Artefacts from ancients' times? Photo by author.



This plantation has many things that resembles a proper micro-forest, it is somewhat enclosed, it is varied and dense, with a mix of species in no apparent order, there are newer and older plants, etc. It also provides much of what is supposedly giving you relaxation and restoration when entering nature, you are feeling enclosed, you are fascinated of what is behind the next corner or inside the enclosed rooms and hedges (Palsdottir et al 2018, Perschardt & Stigsdotter, 2013, Hartig et al 2014, Frumkin et al 2017, Grahn et al 2010). This was a really interesting experience and I could very much recommend everyone to visit this place if they have the possibility and can find it since it was somewhat difficult to find and there were not very good signs to direct you on your way.

Micro-forests are a very interesting concept in the urban landscape due to its flexibility and its values both to increase biodiversity and mitigate climate effects as well as their possible community building properties, both in plantation and in maintenance. We will now study the potential benefits with hybrid micro-forest plantations in urban landscapes.

### 2.3.7 The Use of and Benefits from an Hybrid Micro-Forest

To develop micro-forests of Miyawaki type towards a hybrid state (Owen 2022 p 47) with an area of openness to the surrounding environment as well as a natural playground for creative free play would probably increase the social value and benefits such as fostering new nature values and habits to urbanized school children, increasing kids possibility to free creative play and collective cooperation between teacher - students and students – students (Oh et al 2020), as well as it may support the feeling of place belonging and place identity for local residents and volunteers in the planting and maintenance of the micro-forest. These social benefits change and improve the cost/benefit analysis for the city to invest in this kind of green infrastructure that also have strong environmental benefits such as increased biodiversity, protection against the effects of climate change such as flooding's and heat island effects.

The hybrid micro-forest has similarities with the designs of a therapy garden or a rehabilitation garden like the rehabilitation garden in Altar or Acadia in Denmark (Grahn et al 2010, Palsdottir et al 2018). With its different rooms for different purposes and needs of the visitors. The hybrid micro-forest ideally consists of three distinct areas; the assembly area, the creative playground and the denser Miyawaki-like micro-forest plantation. Modern therapeutic gardens or rehabilitation gardens often has a foundation in the theory of perceived sensory dimensions (Palsdottir et al 2021, Grahn et al 2010) and most likely has elements designed in them with alternate pathways giving the visitors an opportunity to choose their encounters, the gardens has places for gathering and horticultural activities, they have secluded places and more open vistas, where you could see who is coming and going. They are often built with access to water and containing trees (Grahn et al 2010, Palsdottir et al 2018, and Scartazza et al 2020).

The design of therapeutic gardens could also function as a blueprint on how to design effective hybrid micro-forest. Not only the physical space with places to gather, different pathways, rooms to withdraw to, etc. but also the activities utilised within the rehabilitating work in therapy gardens, work that can be used in

an experiential learning situation and in outdoor education directed for pre-schools as an example. Meaningful activities such as gardening and growing your own food, fruits and berries, Horticultural activities, forest bathing, animal care, barefoot walking has a place in a situation to develop communicative skills, creativity and problem solving, to boost self-confidence and cooperation (Oh et al 2020, Yu & Hsieh 2020, Rickard & White 2021, Zhou et al 2019).

The cost/benefit ratio of this kind of plantation is highly improved due to the larger possibilities for human usage combined with the original benefits of the environment (i.e. gains in biodiversity, mitigating climate effects and air pollution). There are multiple societal gains that can be derived from the increased possibilities of usage in a hybrid micro-forest. Gains from nature-based therapy or outdoor education and from opportunities arising when the hybrid micro-forest is used as a creative natural playground.

Within the research of nature-based therapy, adventure therapy, eco-therapy, and horticultural therapy it has been studied what effects activities, cooperation and spending time outdoor has on health and well-being of pre-school students and young people (Perkins 2018, Murphy et al 2017, Verhaegen et al 2023, Oh et al 2020, and Yu & Hsieh 2020). Showing similar results of positively affecting self-esteem, self-confidence, problem-solving skills and creativity, as well as communicative skill, initiative and engagement (Larsson 2022 and O'Brien et al 2011). Outdoor education also has direct effect on the students and teacher health and well-being exposed by lesser sick-days and absence from class (Frumkin 2003, Relf & Lohr 2003, Frumkin et al 2017, and Hartig et al 2014).

Regarding human health and well-being it seems that outdoor activities, social interaction and cooperation with your peers as well as the experience of being in nature support all the three ways that a higher degree of contact with nature promotes better health and well-being; by physical activity and social interaction, by creating positive feelings and less demands on attention and through an increased strength of the immune system through biodiversity (Yin Shan et al 2023, p 2-3).

From another study we can see how a hybrid micro-forest area including places for creative play and outdoor education can be structured. They have shelter in the forest, different pathways to choose from, different places to withdraw to and take a rest, etc. We will study this closer in the text following.



Figure 54: A place to gather. Photo by author.

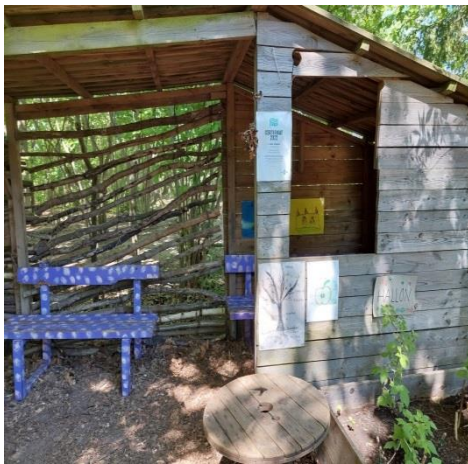


Figure 55 and 56: Some places to relax. Photo by author



Figure 57 and 58: Horticultural activities in a fenced garden and a homemade football field. Photo by author.



This kind of set up of a hybrid micro-forest is recommended as the most beneficial to have for effects on health and personal development (self-esteem, self-confidence, communication skills and team-work), as well as on well-being and experiential learning. Hybrid micro-forest like this can be set up with changing characteristics in different environments adapted for different target groups such as close to pre-schools, in suburbs with low access to greenery, or close to hospitals, etc.

The forest environment has exceptional beneficial capabilities on peoples well-being through biodiversity and release of oxytocin and other hormones and substances beneficial to human health (Palsdottir 2015, Stoltz et al 2016, Uvnäs-Moberg et al 2022, and Grahn et al 2021), the forest also have impact through activities such as forest bathing and barefoot walking (Zhou et al 2019, Rickard & White 2021, Sonntag-Öström et al 2011, 2014 and 2015). The hybrid micro-forest including a garden close to a school has beneficial effects through the horticultural activities and involvement necessary to grow plants, it has effect since it demands cooperation, teamwork and meaningful activities (Oh et al 2020, Yu & Hsieh 2020, Relf & Lohr 2003).

From our study of micro-forests and hybrid micro-forests we have seen that it is not only being in a forest that is important for health and well-being, it is also by doing in nature that we gain several positive health effects. We have seen that, activities in nature, experiential learning or learning by doing embodies knowledge and promote many positive effects such as teamwork, higher confidence and independence, better problem-solving skills, etc. Gardening and connection to plant life, taking responsibility for planning and growing flowers and vegetables in a garden is one easy and effective way to perform outdoor education and bodily movements (Oh et al 2020, Relf & Lohr 2003, York & Wiseman 2011, Larsson 2022, O'Brien et al 2011, Ch. 12).

Now the study will shortly look at where it could be suitable to place these hybrid micro-forests in the urban landscape.

### 2.3.8 Places of Potential Micro-Forest Plantation

Places in urban environments with a potential to harbour wild nature can be of many different characters and purposes (Kowarik 2018, Stoltz & Grahn 2021, p 5, Hung & Chang 2022, p 1-2, Yin et al 2023, p 2-3). They are not seldom the forgotten places in the urban landscape, places such as old industrial areas, transformed waste disposal areas, an abandoned airport or they may be planned greenery such as a large city park or a green corridor in the city.

Malmö as an old industrial town in rapid transformation to a new economy has been filled with old industrial areas abandoned and forgotten, places such as old airfields (Bulltofta), old waste disposal areas (Spillepengen), green Corridors (Limhamnsfälten) and old transformed or semi-abandoned industrial sites, such as (Kalkbrottet and the industrial harbour). These places have been renewed to green and recreational areas, or have potential for spontaneous growth of biodiversity, urban wilderness and urban forestry.

Related to the literature and the performed interviews we have seen a focus on social engagement and local participation in the planning and implementation of a Micro-forest as a key to a successful implementation and positive effects on

human well-being and health (Miyawaki 1998, 1999, 2004, Robinson 2021, and Cardenas et al 2022). There are two areas in Malmö of specific interest for implementation of a micro-forest. First we have the area around the older parts of the industrial harbour with its large green corridors and industrial lots, the area contains many companies that can be persuaded to engage in social development and public-private partnerships to develop micro-forestation. Most of the afforestation projects undertaken by Miyawaki was performed in partnership with corporations in Japan and Asia (Miyawaki 1998, 1999, 2004). Companies have a two-fold interest in promoting greenery outside their premises and in participating in societal project. To engage in social project can give companies very good reputation and publicity from the media and it also seems from research that greenery outside of offices seems to promote workforce creativity and productivity (Yu & Hsieh 2020, and Relf & Lohr 2003). Malmö city itself should be interested in such cooperation since costs of implementation and even maintenance could be lower and since Malmö despite being rich in ambitions and in forgotten places seems less rich in green coverage, as a matter of fact Malmö seems to be one of the municipalities less well off in green coverage according to Buffam and others (2022). Another place of interest for micro-forest plantation in Malmö is the large green corridors and sports fields between the city centre and the ocean. These fields are large areas of open meadows and fields with dense vegetation, hedges and bushes along the edges. These sport fields are frequented by many sport associations and volunteers, citizens engaged in the local community. These people are used to social engagement and should possibly be easily convinced to support the implementation of new micro-forest plantations along the bushy edges of this green corridor. Such a placement would engage the local population as well as use the terrain to cover the potential “messiness” of a new micro-forest plantation. One main objection about micro-forests in urban landscapes are that their dense structure give people a messy impression and people often prefer an orderly structure in urban nature (Bengtsson & Grahn 2014, Grahn & Stigsdotter 2010), see my talk with the dog walker at Ankarparken as an example. Therefore the dense vegetation around the fields can act as cover for this messiness.

But placement of micro-forest and hybrid micro-forests is of course possible in pre-schools and school-yards, hospitals and retirement homes, in between residential areas and other suitable areas close to interesting target groups/beneficiaries, as we saw in the interview with MKB regarding the plans to implement a new micro-forest plantation in the residential area of Augustenborg (see chapter 2.3.5).

The study will now shortly focus on how stakeholders in the city reasons around the dense and green city landscape and how they think about urban forestry.

## 2.4 Urban Planning of Green Infrastructure

In the development plan for Nyhamnen (Malmö Stad 2019, Fördjupad översiktplan för Nyhamnen), the unique opportunity this district offers is emphasized, with its central location in the city and in the wider region of

Northern Europe. The document point out that cooperation from the entire organisation within the administration of Malmö city is necessary as well as it is necessary to develop new ways to cooperate and to try new experimental work-methods with the private sector as well as the non-profit sector.

Some principles for the development are that this urban landscape shall be rich in variation, contrasts and experiences, green and blue environment shall be present throughout the whole city district and the constructed landscape shall invite you to social interactions and meetings. Buildings shall be rich in variation, levels and contrasts to the benefit of human perception as well as environmental factors such as the interruption of strong winds (Malmö Stad 2019, Fördjupad översiktplan för Nyhamnen, p 30). Architecturally interesting buildings should be placed to function as landmarks facilitating orientation. Street levels should be “transparent” and open for activity to induce feelings of safety and a low traffic tempo should be the norm to promote streets suitable for kids, young people and the elderly (Malmö Stad 2019, Fördjupad översiktplan för Nyhamnen, p 30). Places and buildings of significance for the cultural history should be preserved to build place identity and for the purpose to contain activities that are community building (Malmö Stad 2019, Fördjupad översiktplan för Nyhamnen, p 32). Factors such as variation in the streetscape and house facades as well as keeping a connection to the historicity of a place was, pointed out in the chapter about the dense city and were we did a comparison of street levels of a new compared to an older city street.

The planning documentation for Nyhamnen also points to the importance of green innovations and environmental solutions to meet challenges from a changing climate, such as protection from rising sea levels, open storm water management systems in the green corridors, and that they shall be incorporated in the development of this new city district. Nyhamnen shall be perceived as green and the local residents should have access to greenery within 300 meters without crossing any major streets. A specific green and blue plan will also be created for this city district to push the importance of green solutions.

This study suppose that interesting environmental solutions and new cooperation between interested partners will be developed as has been done in the development of Södra Hyllie and Augustenborg where property developer and the city has initiated new solutions of shared economics and circular thinking (Malmö stad 2023 Översiktplan Malmö stad, Malmö stad 2019, Fördjupad översiktsplan Södra Hyllie and Malmö stad 2024, Embassy of Sharing, Malmö Stad 2019, Fördjupad översiktplan för Nyhamnen).

#### 2.4.1 Insights of the Importance of Trees, Urban Forestry and Micro-Forests in Urban Planning

We have seen that urban forestry and micro-forests are important in the urban landscape from our interviews and from the development plans of Malmö and Helsingborg. Has this insight penetrate into the administrations responsible for the management in Malmö?

Trees, forests and especially urban forest have quickly become even more important than ever before and a hot topic in academic circles as well as in city planning. We can see this rising interest for urban forestry in such details as the

inclusion of the 3-30-300 model in urban planning, the model requires increasing amount of green presence in cities and the model focuses on trees as a mean to achieve that. The 3-30-300 model (see Ch. 2.2, p 12) is explicitly mentioned in the blue and green plan of Malmö. A plan produced by the same department and department head that is interviewed later in this study, giving us a clue on the importance of trees and urban forestry in city planning. The model is also present as a specific planning document of Skånes regional authorities “Region Skåne”, an organization that together with Länsstyrelsens “green structural plan” functions as guidance and coordination of municipalities and cities in Skåne (Malmö stad 2019, Plan för Malmös gröna och blå miljöer, Region Skåne 2023, 3-30-300 i Skåne, and Länsstyrelsen 2024, Grön infrastruktur i Skåne).

Trees particularly old trees are hosts of large amount of biodiversity within them and they also have a large tree canopy or green coverage helping with carbon capture, the heat island problems from climate change and the problems for vegetation and animal life following a dry urban landscape (Beatley 2016, 2024). This was also mentioned explicitly by the landscape architect and tree-specialist that was interviewed in Helsingborg as reasons for the rising importance of urban forests and trees. Another aspect of the rising importance of trees and urban forests is connected to the demand for a rising density following the population growth of cities together with the biophilic ideas on how to design a modern sustainable city. As mentioned earlier the issue was also raised in my interview with the local authorities in Malmö that is responsible for the outdoor environment in the existing city. In that interview it was mentioned that there is a focus on trees and that a pleasant but problematic challenge is following, namely were to put all the new trees? This dynamic situation of a growing population demanding green areas as well as the opposing demands on more houses to live in, making the dense city a necessity which is creating a less green city is a puzzle to solve. Maybe this is an opening for micro-forests and hybrid micro-forest plantations?

Trees can be planted in streets, on squares and in parks, but to accomplish what would be necessary to reach the goals demanded by politicians and in visionary planning documents it is not enough of room in our cities (McDonald 2023). Plantations such as micro-forest could be a possibility, but also innovative solutions derived from biophilic design such as green roofs and vertical green walls, designs implemented in Augustenborg and in Helsingborg respectively (Malmö stad 2024, Eco-city Augustenborg, and Helsingborgs stad 2024, vertikala trädgårdar).

Around the world in a rising number of biophilic cities new and fascinating ways to plant forest and increasing the green canopy coverage are tested. To illustrate that even forest, or at least trees can be vertically created in the urban landscape I will show you some pictures from Timothy Beatleys public lecture on YouTube in 2020 (Beatley 2020).

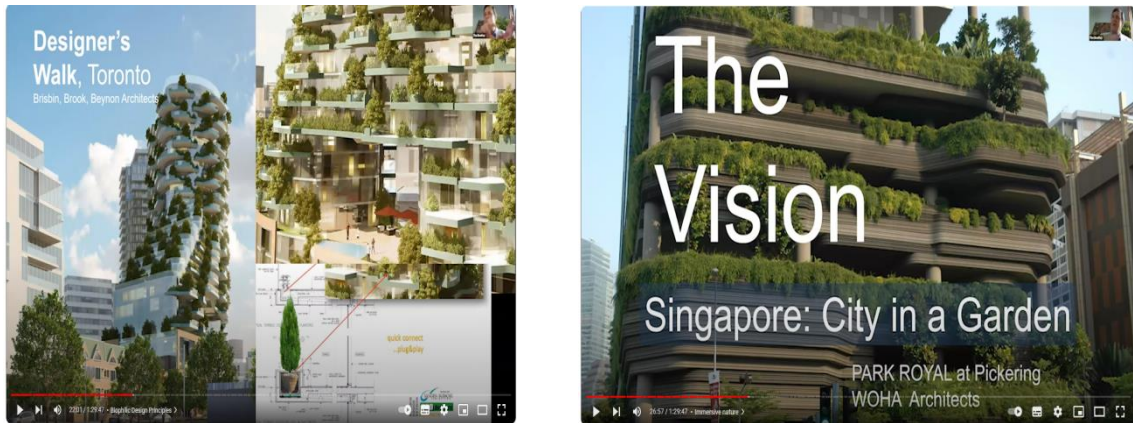


Figure 59 and 60. Examples of innovative biophilic design and a view on a vertical forest. Photo from Beatley Timothy 2020, YouTube video.

Innovative thinking is an ear-mark in biophilic design and a necessary part in modern urban planning if we want to solve the multiple challenges of today's modern city. Now we will look into the world of a practitioner working with the outdoor environment of Malmö. It is a point of view from a professional stakeholder.

#### 2.4.2 A Stakeholder Perspective: Interview with the Department for Outdoor Environment in Malmö

If we compare a new development such as Södra Hyllie or Nyhamnen with the already existing city, you are much more constrained in what is possible to do as an urban planner, landscape architect or ecologist with the green infrastructure. To get some thoughts from the profession on how to incorporate green infrastructure and urban forestry in the existing city the study have interviewed the head of the Unit of Urban Environment (stadsmiljöenheten), a unit responsible for the outdoor environment in the city.

In the interview we are talking about from where their projects and missions originates and there seems to be three main way to start a project; through the political decision-makers, through the citizens and through the civil servants themselves. According to the interviewee the political decision-makers are giving directions and are looking at projects much more in detail nowadays than they did before. Maybe this is a sign of the increasing interest from the public, from media and hence from the politicians of the importance of green infrastructure and the environment in society.

New projects seems to be initiated by the administration and co-workers that have a large mandate to search for and collect knowledge and new ideas around green infrastructure and its effect on citizens' well-being and health. "We want to be in the forefront", as Agneta says. It is important for a larger municipality as Malmö to dare to try, to experiment a little, to lead the way and to be an inspiration to other smaller municipalities. There seems to be opportunities for individual initiatives and for the bureaucracies to engage in different projects within the general directions of the visionary planning documents.

The interviewee mentions how important cooperation is when to start a project. During the project to make the square at Triangeln more attractive much of the



work was made together with the property owners around the square. This was a project initiated by the property owners as well as co-financed by them. Agneta says that; “We are working more and more with having a stakeholder dialog before we do changes. We try to have a dialog both with the residents around a project, as well as the users of a place that need change”. This is way for property owners to have influence on what is done in the city.

How do the unit measure what effects their projects have? They seldom do. Instead they work with stakeholder dialogs before and during projects, trying to capture what people need and want to have, incrementally changing the projects. If a place becomes much more frequently visited after a rebuild of a public space or a plantation of new park or playground that would be a sign of apparent success. These rebuilds, like the square at Triangeln rebuilt to make it more pedestrian friendly, or the ongoing reconstruction of many streets in Malmö in a biophilic direction and finally projects like Grönare Möllan (a project done to plant new trees and innovative storm water solutions in the city centre, more about that later), show us that trees are on the agenda or as Agneta says, “Malmö is at the forefront in trees, planting trees, yes we definitely are”.

The interview are focusing on forest environments within the city and what Malmö has accomplished and some of the difficulties of integrating a forest environment in an urban landscape. –“Regarding trees and forest environments in the urban landscape, we had or have a project within Nyhamnen that is about urban forests but I am not quite sure of the status of it”, said Agneta. “But for me the Millennium-forest is the most beautiful place we have in Malmö”. This forest near Katrinetorp is very close to E6, the highway around Malmö. “Even with that placement you think, when you are there, that you are out in an old virgin forest somewhere. I think it is a fantastic place”, says Agneta. Our parks are not so inviting for free play, to build small cabins or to play with sticks and branches, (something I liked when I was a kid), said Agneta. So places like the Millennium-forest and Bulltofta that are a bit wild, messy and rough are necessary for people.

If you think what you are most proud of what would that be, I asked? Our thematic-playgrounds obviously, we are good doing them. And of course the millennium-forest. But now it is a very large focus on trees in urban planning and since we have the park areas that we have, but more and more people are moving in, we need more trees but we have no more places to put them. Therefore I really like working with hardened environment. Hardened environments that we could rebuild making them greener and more suitable for people, like a project we worked with, Grönare Möllan (The Greener Mill) financed with assistance from a national authority (Boverket). Möllan is a centrally located square in the south of Malmö, an older working class environment from Malmö's industrial era, nowadays a place influenced by the creative class and multiculturalism. In this project trees were planted on parking lots and at the same time a storm water system was built up in this very urbanized environment. A clear change of the city in a biophilic direction, showing us how important trees and urban forestry are when changing the city. A challenge we have if we want to achieve the demands for higher canopy foliage coverage is to put trees everywhere and pack them tight on our few available places and city squares that is one of the reasons I really like working with projects like “Grönare Möllan”. We need to think differently, out-of-the-box. I think that it is connected with a change in thinking about traffic and

cars, says Agneta. A challenge to this out-of-the-box thinking is that a municipality is a very complex organization with many different interest coexisting, sometimes there are goals of more plantation of trees at the same time as we cut down trees in other places, according to Agneta.

Our interviewee finished the interview with a strong promotion of the aesthetics! That you are allowed to say that something is just beautiful and work for that purpose. That you do not need to find something measurable all the time or some reason to do certain changes. “Sometimes it is so, that it is just beautiful. So therefore I want to finish this interview with a stroke for the beauty of the aesthetic experience”, said Agneta.

### 2.4.3 Implementation of Micro-Forests in Urban Landscapes

As we have seen from the interviews and written information, changes and green innovative action often take place due to initiative from solitary civil servants often backed by trust from management letting their personnel taking initiatives. We can see such processes in the anthology of Augustenborg (Månsson & Persson 2020, p19-20, 27-28) and from the interviews in Helsingborg and Malmö, where the responsible landscape-architect had relatively free hands to install the 17 micro forests with his own budget and the interviewed manager for the outdoor environment unit in Malmö was praising the drive and initiative of her employees. We can also see the new project of micro-forest plantation in Augustenborg initiated by MKB and Naturskyddsföreningen.

The driving force of individual civil servants or politicians seems to be a factor in the incremental and individual implementations of biophilic new designs, such as the micro-forest plantations in Helsingborg or the early development of Augustenborg in Malmö as a place for experimental environmental solutions (Månsson & Persson 2020). We have also seen that every strategic planning document focuses and direct attention towards goals of increasing biodiversity, environmental green infrastructure and human well-being and health. A focus that has affected and eventually will affect practical policy even more. This is a really important step to get actual implementation and effect in the construction and design of a sustainable city, since these visions are making their way into the mind and knowledge of the professions that implement changes in the city, and that is an effective way for change, according to Söderlund and Newman (2022. p 11).

To be successful we have seen that cooperation is important, cooperation and financing from private companies and the civil society is necessary in successfully developing green infrastructure in the urban landscape. We have also seen how important the involvement and engagement of the local community and the local residents are in the construction of micro-forests, in this case cooperation almost a prerequisite that has many benefits is. Benefits on our health and well-being, and on how we connect to nature, and how we build a better community.

## 2.5 Summary

Since we have, in our study of the urban landscape, immersed in places of dense urbanization, investigated places of a urban wilderness, looked into the visions and planning of new city districts and search deep into the concept of micro-forests we could best be served with a short summary of what we have seen and experienced.

We have seen and compared the modern dense city centre with older urban environments and noticed differences in appearance and in perception of such places. We have noticed clear differences in colour schemes, in the structure of buildings, in how streets are following the topography. The older city is more colourful and rich in variation. There are features luring us to explore and making us comfortable, features that could be comparable with nature and natural variation-rich environments.

Moreover we have continued looking at how we are trying to build in nature in the modern city landscape, introducing curvatures, water and green spaces for citizens to enjoy and restore in. We have studied a forest-like park, trying to capture people's perception of urban small spaces and how the development of urban forestry and micro-forests has progressed in Malmö and Helsingborg. We have seen that urban forestry and even the concept of micro-forests are very much in focus for urban development at the moment.

Finally we have been looking into modern city planning with interviews and studies of city planning documents to see how politicians and city officials are reasoning on how to develop a resilient, sustainable city. We have seen that the green and blue infrastructure is of extremely large importance in planning documents and most often in the minds of city planners. Almost all vision statements and strategies for urban development have environmental goals in them and even more interesting is that we detected that human health and well-being explicitly has been mentioned and put in top of the designated targets for urban development in Malmö.

The green agenda is on the rise and we will now continue to discuss what kind of conclusions and ideas we can draw from this investigation, looking at how the factual urban development connects to urban forestry and especially to micro-forests and hybrid micro-forests and theories of human health and well-being.

## 3. Reflections and Discussion

In this work I set out to gain some knowledge about how green infrastructure are incorporated into modern city planning and to see if the concepts of micro-forests and hybrid micro-forests are an opportunity to introduce restorative and instorative environments in an urban landscape. I have asked myself what benefits the implementation of micro-forests, hybrid micro-forest and green infrastructures promotes and enables in a city environment? And if stakeholders and city officials know about urban forestry and its possible benefits to human well-being? The work has been influenced by the perceived value of nature discussed by scholars such as Stoltz & Grahn (2021) and especially by the Explore-Refuge dimension investigated by Grahn et al (2010), when they analyse the effects of the rehabilitation garden in Alnarp.

### 3.1 The Dense City and Biophilic Ways to Undense it

We have seen that nature, greenspaces, blue and green infrastructure, urban wilderness, urban forests and micro-forests are becoming subject of a strongly rising interest of how to design and build resilient and sustainable cities (Beatley & Newman 2013, Newman et al 2017). Especially trees and urban forestry are of interest both to the professions and to academia; as we have seen from our interviews in Malmö and Helsingborg, from planning documents looking at the 3-30-300 model and from an increasing interest of writers such as Beatley and from professional associations of urban planning (Beatley 2024, Schwab 2009, Nilsson et al 2011, Esperon-Rodriguez & Harrison 2022, Zürcher 2022). We can also see it from the growing interest of micro-forests and urban forestry (Cardenas et al 2022, Kowarik 2018, and Yin et al 2023).

Theories of biophilic urbanism together with the concept of urban nature and micro-forest has an important function in the planning and construction of a sustainable city promoting human well-being and health, a city that is people-friendly and considers our perceptions and senses in its construction and in our access to nature in the urban landscape. We have seen this in our study of the dense city and our perception of it and how urban wilderness, green corridors and hybrid micro-forests are affecting our desires to be outside, in nature or nature-like environments, doing activities and having social interactions.

If we are looking at some of the hallmarks of biophilic design comparing them with what we have seen in our investigation of Malmö and Helsingborg we can see many characteristics of biophilic urbanism and a biophilic city from our study. Starting with green parks and greenspaces, this is an obvious opening that any city



want to have and even if Malmö seems to have one of the lowest greenspace coverages in Sweden (Buffam et al 2022, p 05), there is no lack in ambition to be better. Another characteristic is the incorporation of natural materials and forms in the city, we have seen from our visit in Ankarparken that natural materials such as wood, and stone are incorporated into the park design, as is the form of the shoreline and pathways meeting the water in the park as well as the rounded forest groves. From the planning documents concerning Nyhamnen we could see references to street level architecture such as daylight and views are included in the development plans with ideas on creating sight-lines of green views towards the sea and towards different landmarks to help orientation in the city. Augustenborg in Malmö is well known for its experimental green roofing, studied by many European delegations and Helsingborg has experimented with green walls (Helsingborg stad 2024, vertikala trädgårdar), creating living biodiverse walls and roofs. Regarding water features both Malmö and Helsingborg are seashore cities manifesting itself in Malmö's specific planning of blue and green environments (Malmö Stad 2019, Plan för Malmö's gröna och blå miljöer). If we look at a biophilic streetscape we see endeavours to make the streetscape more people-friendly in projects such as Neptunigatan and Grönare Möllan, we also see this ambition in the new planning for Nyhamnen. These activities in our investigated cities are all connected to biophilic design ideas (Hidalgo 2014, Beatley 2016, Browning et al 2014, and Kellert 2008, 2018).

To conclude with a very important lesson we have learnt when conducting our case studies, a lesson that may be important for modern city planners, and that is the importance of the streetscape. If we look at the difference in topography, curvature, structure and colouring of the streets in a modern city district compared with the streetscapes in an old town or a city inspired by biophilia. These later streets are much more nature-like. Making people more comfortable and enjoying their environment more. Thereby being more beneficial for urban life and human well-being.

## 3.2 The Role of the Micro-Forest in the Urban Landscape

Micro-forests are good for creating urban greenspace in the scarce areas available since they are so potentially rich in biodiversity, but there are hesitations to implement them due to uncertainties on maintenance, public perceptions of the dense vegetation and costs. Over and over again we have seen the importance of engaging the local residents and the local community in planning, implementing and maintaining the micro-forests since this is an important part of the economic calculus of such a plantations (Egerer & Suda 2023, p1333, Robinson 2021, Cardenas et al 2022 and Ryan et al 2023) but even more important is that the local engagement has a value in itself. In modern society and specifically in the large cities engagement for your local community is often missing. Therefore it has a value if people can start work together feeling responsibility for their neighbourhood, doing activities, teamworking and community building. Bonding

to your community is beneficial for the health of the individual, for society and for nature (Frumkin 2003, Lewicka 2011, 2013 and Manzo 2003).

One important lesson from the literature study is that preferences change. What kind of environment we prefer change with our needs for the moment (Stoltz & Grahn 2021). Sometimes we are tired, sometimes we are seeking for social interaction. Preferences and perceptions also changes between individuals, between ages, gender etc. Therefore both restorative and instorative qualities are important and we are able to find both these qualities in a hybrid micro-forest.

We can find some serene qualities as bird's song, wind in the trees and the sounds of insects as we can detect from places such as the Millennium-forest and in the hybrid micro-forest/playground in chapter 2.3.7. Especially in the later we also find instorative qualities equally important for human well-being, such as the potential for movement, cooperation and teamwork affecting self-esteem and other sentiments. The hybrid micro-forest promotes this prospect-refuge dynamics basic for our well-being and described by Stoltz & Grahn (2021). The hybrid micro-forest contains at the same time PSD-qualities such as Shelter and Open, as well as Serene and Social depending on how the hybrid micro-forest has been constructed and on how it is used. Open and Social can easily dominate their counterparts and weaken the restorative environment (Stoltz & Grahn, 2021 p 6-7) so knowledge of that should be carefully incorporated in the design of an hybrid micro-forest, even though the activity part can be the most important role that this kind of forest is supposed to have. The hybrid forest fits pre-schools and elderly homes with small adjustments, it suits both instorative as well as restorative purposes.

In our thinking of the hybrid micro-forest we are focusing on the instorative qualities or the role of activity and creative play that a hybrid forest has. We are focusing of the playground and the place for gathering and social interaction. The place is stimulating, has views and open vistas (Stoltz & Grahn 2021). By promoting being in nature, learning about nature the hybrid micro-forest can foster love for nature or place attachment to nature (Grahn et al 2010, and Morgan 2010), that later help strengthening the individuals health by the memories and the recognition and remembrance of affordances that nature can give (Grahn et al 2010).

What is the potential for hybrid micro-forests in the urban landscape? We can see a better cost/benefit calculus making micro-forest more interesting if they can be built and used in places such as Kindergartens, pre-schools, hospitals or just at a court-yard in exposed residential areas. In places like this the hybrid micro-forest can function as an playground for creative play and activities, an eco-education place fostering respect and understanding for nature as well as it functions as a tool to create local engagement and place attachment.

These are some of the reasons why the placement of micro-forests is of importance in modern city planning. Should they be placed in school-yards, in retirement homes for the elderly, near kindergartens, in-between residential buildings, elsewhere? What is best? In contrast to urban nature or urban wilderness that develops spontaneously in abandoned and forgotten places such as old waste disposal areas or industrial lots that has been subject to the creative destruction of economical down-turns and disruptions from industrial changes and new technological and economic trends, micros-forest are planted and planned by

people. The location of micro-forests has an impact on community building, biodiversity and the possibilities to mitigate climate change, so to build them at the right place matters.

In the study of the dense city we have identified some potential places for locating micro-forests in Malmö as the semi-abandoned green corridors in the industrial harbour and the densely vegetated edges of the large fields of Limhamnsfälten. The first place is opening up for partnership and financing from private companies (Miyawaki 1998, 1999) in the industrial harbour and the second place, Limhamnsfälten has a multitude of potential volunteers (Cardenas 2022, Robinson 2021), with all of its sports associations. This is a possibility, to engage the general population building engagement and community bonding that does not seem to be explored fully. Sports associations and companies from the private sector could be used to increase local engagement in the maintenance and plantation of urban forestry in public-private partnerships or as in the case of MKBs planned micro-forest plantation by the help of local residents. This could also be a possibility to improve the cost/benefit calculus for this form of investment in green infrastructure. It will also be interesting for private companies since access to greenery increase well-being, creativity and productivity of the employees as well as it gives the companies a good reputation for social responsibility (Ryan et al 2023, Ch. 2, Wijesooriya et al 2023, p 4-5, Yu & Hsienh 2020, Song Ping Xiao et al 2018).

### 3.3 The Benefits of a Micro-Forest in a Nordic Perspective: The Case of Southern Sweden

Micro-forests can have multiple effects on society, on the environment and on the health of the individual. The hedged area of a traditional Miyawaki micro-forest is extremely rich in biodiversity, which is a good in itself. But being in nature exposing yourself to a biodiverse environment are strengthening the immune-system (Frumkin 2017 and Uvnäs-Moberg et al 2022). A biodiverse, green forest are also mitigating climate effects with functions such as storm water drainage, and easing heat island effects in urbanisations, the dense vegetation also functions against air pollutants and as a carbon trap. A micro-forest can have social effects, even on criminality (Ryan et al 2023). By promoting social interaction, and engagement in the local community activating feelings of place attachment it affects the local community and people's well-being and perception of security. A hybrid micro-forest if placed well, as in between residential houses, close to hospitals or elderly care facilities or near pre-school can foster movement and activity as well as it promotes less demand on attention by being in nature according to the Kaplan's (1989). It is also a place to foster long term connection to nature in the pre-school environment, thereby by the scope of meaning/scope of action theory, a process described Grahn et al (2010), fostering future memories and our perceptions of affordances given by nature. Movement and activity in a hybrid micro-forest like pre-school environment promotes teamwork, social interaction and communication, body awareness affecting self-esteem and

confidence having beneficial effects on human well-being (Oh et al 2020, and Yu & Hsieh 2020).

One main point of the Miyawaki-forest is that of involving the local community and residents in the plantation and maintenance of the urban forest. In the interview in Helsingborg we could see that the general public was informed by signs about the purpose of the plantation and we have also seen that workshops are being made with pre-school classes and kindergartens to eco-educate them. This is an effort to introduce outdoor pedagogy and education and to utilise the plantations for social benefits. The possibility of community bonding by creative play, eco-education and letting people engage in the maintenance and creation of their neighbourhood is not yet fully explored, thereby missing an opportunity for community building. Helsingborg has otherwise been forward-leaning in experimenting with new kind of forest-plantations. How about Malmö? Do we see the same focus and will to experiment there?

MKB is as we have seen planning a plantation at Augustenborg with the active participation of the local community with the intent to create engagement and place identity for the neighbourhood. Augustenborg is a place where solutions to involve the neighbourhood has been tested before with good results. The intent is to create responsibility through engagement, making people to be outdoors creating a feeling of security and care-taking.

Ankarparken have not the exact design and features that is characteristic for micro-forests of Miyawaki style. It does not have the density or plant variation nor the edges with flower and berry rich vegetation that is attractive for pollinators and in creating a biodiverse habitat. Still it has some of the social benefits of an hybrid micro-forest, such as eco-education and possibilities for creative play. Ankarparken also has qualities of being a restorative place according to the theory of perceived sensory dimensions (Palsdottir et al 2018, Stigsdotter et al 2017, and Bengtsson & Grahn 2014). It has the water front with multiple possibilities to find seating places taken a relaxing moment before going on, there is possibilities to listen to the sounds of nature, to sea-gulls, to the reed vegetation moving in the wind. Therefore this place is well qualified to be a restorative environment in the urban landscape. But not only that, it is also a place promoting instorative qualities, such as the creative play seen from the pre-school students actively seeking out adventure in the park with almost unsupervised free play, and from their nature experience trying to catch some fish in the canal.

The results from the questionnaire are also interesting. The results say to us that even if people are only passing by and stay five minutes or less, or maybe up to ten minutes at the most, they perceive themselves as calmer than when entering the park. Water, such as Kellert's' environmental features and even Beatleys' river systems, and open vistas seems to have an effect on their mental state and most likely, according to the studied literature, on their restorative capabilities (Sonntag-Öström et al 2014, Kellert 2008 and Beatley 2011). It is also of interest that people sought after more wilderness and possibilities for exploration in the forest groves, opening up for a confirmation of the perceived sensory dimensions of both space and prospect combined with Kaplan's' soft fascination. This park with its forest groves and pathways combine the dynamics of prospect vs refuge.

The Millennium-forest is a perfect example of a large hybrid micro-forest with a dense and varied plantation of different species, rich in wild life and restorative



features such as hedges, rooms within the forest and constructions rising your interest and need for exploration, luring you with mystery and keeping your soft fascination on high alert. This place also awakens your sense of being in a place with historic significance when you discover the stone constructions within the forest. This place gives the visitor a lot of possibilities for restoring their senses and for activating pleasant memories and thoughts. The fascination that you as a visitor experience, that soft fascination is exactly what the Kaplan's (Kaplan & Kaplan 1989) describes as something that let your senses rest and restoring you from long-term stress (theory of ART, described by Grahn et al 2010, Palsdottir et al 2018, Grahn & Stigsdotter 2010). This is a reason why urban nature or urban wilderness is important (except for the obvious reasons such as biodiversity and mitigating the effects of climate change).

The hybrid micro-forest has potentially multiple benefits in Sweden and the Nordic region since we have a highly urbanized population especially in Southern Sweden, and a low canopy coverage in cities as Malmö (Buffam et al 2022). The region also has a well-established developed infrastructure of pre-schools, homes for elderly care, hospitals and residential areas in need of greening and social efforts (see the million housing program from the 60:ies and 70:ies), with large potential benefits from hybrid micro-forest plantations. The expected effects on society, on the environment and on the individual from hybrid micro-forest in such places would be beneficial.

### 3.4 How Can a Hybrid Micro-Forest Affect our Health

Why do greener cities matter? Nature and landscapes are inherent or innate in us and that makes us feel comfortable, relaxed and makes us feel at home, not a bad base for well-being and health (Appleton 1975, Oriens 1986 Kaplan & Kaplan 1989, Bengtsson & Grahn 2014, Peschardt & Stigsdotter 2013, and Taylor et al 2011). Close contact with nature affects our bodies and releases hormones and signal-substances that affect us in many ways and certainly are good for our health and well-being (Uvnäs-Moberg et al 2022, Stoltz et al 2016, Zhou et al 2019, Hartig et al 2014, and Frumkin et al 2017, and Bratman et al 2019) Nature, and it seems, especially forests have an effect on human health, both higher cognitive functions and physiological functions as blood pressure and heart rate (Hartig et al 2014, and Yu & Hsieh 2020, p1-2).

But why is a hybrid micro-forest special in its effects on human health and well-being? Hybrid micro-forests has an instorative as well as a restorative effect on human well-being. By activity, creative play, bodily movement, social interaction, and teamwork functions beneficial to health such as communicative skill, self-esteem and self-confidence are being developed. Activities such as forest bathing, animal care, barefoot walking and horticultural activities has beneficial effects not only to your body but to your mind as well, physical activities may stop unhealthy thoughts of traumatic events. It may also start a self-reflection on your situation and give ideas what to do about it. Cooperation and teamwork in combination with accomplishments increases self-confidence, self-esteem and interest to change the situation (Stigsdotter et al 2011, Ch. 11, Pedretti-Burls 2007, and Perkins 2018). Social interaction, group work or team

work, caring for others, doing activities and accomplish results increases self-esteem, gives a bodily experience and increase learning through embodiment (experiential learning) or learning by doing.

Learning by doing is an important activity made possible in a hybrid micro-forest. Learning by doing increase interest, stimulate memory through multiple sensory stimuli see for example Larsson (2022) and O'Brien et al (2011). It stimulates cooperation and give you experience of social interaction that is beneficial for health and well-being (Oh et al 2020, and Yu & Hsieh 2020). With activity and working together as a group follows engagement and teamwork. A feeling of responsibility is developing. As well as it fosters connection to a place and of the members in the group (Oh et al 2020, Perkins 2018). The hybrid micro-forest promotes better health since it is designed for creative play and collective activities that foster team-work and strengthening other important triggers to our perceived health, such as a heightening self-esteem, etc. (Oh et al 2020, Pedretti-Burls 2007, and Veerhoeven et al 2023). The effects on human health and well-being from team-building activities and movement in nature are well established within science (Elmqvist et al 2015, Yu & Hsieh 2020, Oh 2020, and Pedretti-Burls 2007).

By being outdoors in nature we are exposed to a landscape rich in variation. People are stimulated by fascination and sensory impressions from sound, smells, touch and vision calming them, lowering their stress exposure (Kaplan & Kaplan 1989). Being in nature, in contact with a more biodiverse outside stimulate and develops the immune-system with positive effects on health and well-being (Frumkin et al 2017, Hartig et al 2014 and Uvnäs-Moberg et al 2022). But effects on health and well-being also come from doing, from meaningful activities done with the aid of nature. An instorative environment and activities stimulate humans and in our case pre-school students in several ways (see Ch. 2.3.7 and Ch. 2.3.4). The outdoor landscape with a variation of materials to be utilised, with stocks and stones to jump on, with berries to pick and flowers to smell, with sticks to be tossed, with shores to be done promotes physical movements, it promotes creative play and exploration, evolving the curious mind. Furthermore doing outside activities encourages cooperation and teamwork within the group, both student to student and student to teachers. These activities and feeling of accomplishments when they are done promotes increased self-confidence and a higher self-esteem amongst other effects. As an extra plus humans when spending time outdoors are less exposed to harmful compounds and chemicals that our indoor environments are full of (Relf & Lohr, 2003, p 985).

As seen in the study from the literature and from the landscape analyse, forests are important for outdoor education and for health (Larsson 2022, Yu & Hsieh 2020, Manni et al 2024). The environment is rich in variation and offers a range of activities, such as forest bathing (Hansen et al 2017, Zhou et al 2019). The forest also offers protection from the environment as seen in chapter (2.3.7). Therefore it is positive if schools interested in outdoors education and experiential learning has close access to a forest or a forest grove (Larsson 2022, Murphy et al 2017). We have seen that, activities in nature, experiential learning or learning by doing embodies knowledge and promote many positive effects such as teamwork, higher confidence and independence, better problem-solving skills, etc. Gardening and connection to plant life, taking responsibility for planning and growing

flowers and vegetables in a garden is one easy and effective way to perform outdoor education and bodily movements (Oh et al 2020, Relf & Lohr 2003, York & Wiseman 2011, Larsson 2022, O'Brien et al 2011, Ch. 12).

To once again look at restorative places in the urban landscape bearing in mind our insertions into the greenescapes of Malmö. We can see that there are many such places from recreational sports fields, to parks, to abandoned industrial sites, and to forest-like areas. Forests are extremely restorative as we have seen in this study. From our questionnaire, we saw effects on how people perceive their health after spending time in nature. They perceived themselves as being calmer from a very short time in the park. This time could be spent on a small urban greenspaces, or in parks, maybe in some urban forests, or taking a walk close to the sea, maybe it could be time spent working with or looking at the flower-rich edges of a micro-forest. We have seen from the literature the large effects on health and well-being in the Japanese concept of forest bathing, which is a well-established restorative cure in Japan (Zhou et al 2019, Stoltz et al 2016, Sonntag-Öström et al 2014, Stigsdotter et al 2017). We have also seen that trees and forests are a focus in city planning both in the creation of urban forests such as the Millennium-forest in Malmö and in the plantation of 17 hybrid micro-forests in Helsingborg. Making us believe in the importance of promoting hybrid micro-forest plantations in the modern dense city.

During this study we have seen that access to green space and particularly forestry are important for your health and well-being as being a person living in an urban landscape. Nature gives you sensory stimuli that are in accordance with how you are functioning thereby providing restoration for body and mind. Furthermore in an urban landscape social interaction and physical activity is important this is possible to attain with micro-forest plantations involving the local community thereby creating community bonding and community creation, something that is also attainable by the activities facilitated in and by a hybrid micro-forest.

What implications does the influx of more people into the cities with demands on denser city planning in combination with more research and more physical evidence on the necessity of access to greenery and experience of nature for human health and well-being give for urban planners, political decision-makers and other stakeholders? One conclusion possible to make is the need for a cost effective way to implement trees, forest and green infrastructures in urban landscapes. We have seen a cost effective way to plan for both an instorative as well restorative environment close to many target groups in the hybrid micro-forests. A multi-purpose green infrastructure suitable to build on the shrinking available spaces in the modern city.

### **Limitations and Further Studies**

This study has been confined to a literature review followed by case studies concentrated on the dense city and urban forestry. The study have also been interviewing professional stakeholders responsible for urban planning urban forestry and outdoor environments within the city. The investigation might be perceived as being somewhat anecdotal in nature. However it still has general value in the information collected and in the conclusions drawn from this information. The survey has interesting results in how visitors perceive the effects

of their often short visits. Other limitations in this study that could be of interest for further studies are that no measuring of the actual effects on the people spending time in an hybrid micro-forest have been made nor has there been any sensory measurements of physical effects of outdoor activities. Neither have there been any long-term investigation of health and well-being on people exposed to outdoor green environments compared to people not having experience from outdoor doing and being. All of these limitations on this study would be interesting to explore in depth in future studies.



## 4. Conclusions

What have we learnt from this study? We have seen that Malmö has a very large focus on becoming a sustainable and resilient city. A place with focus on green infrastructure, a city working hard changing its 'streets to more people friendly streets, and building smart innovative environmentally friendly solutions to mitigate the effects of climate change. Malmö has a focus on trees and green communication, creating new city districts that are sustainable with less traffic and that contains much biophilic elements. Trees and urban forestry are high on the agenda when you talk with officials from the cities so there are knowledge of the importance of urban forests and a will to implement forestry programmes in new development as well as in the reshaping of the already existing city. Micro-forests however have not yet really been accepted or been implemented to its full potential, even though we have detected several obvious benefits with them.

Why do we care? The dense city needs cost effective places that both attracts and calms. The cities need places that foster the younger generation into appreciating and understanding nature and they need a green infrastructure for environmental reasons as well as human health reasons. The hybrid micro-forest fulfil these demands and more thereto. Implementing micro-forests and especially hybrid micro-forests will have many benefits. They grow fast so you get results from them quickly. A hybrid micro-forest has individual benefits such as giving access to nature and creative play, it can be used for outdoor education and it will by teamwork and bodily movement improve both physical and psychological health, The hybrid micro-forest will also have environmental benefits, such as increasing biodiversity and mitigating adverse effects of climate change, for example when functioning as storm water management or carbon capturing. Finally it can have large benefits to society by promoting social interaction, fostering neighbourhood engagement increasing social responsibility and even decreasing crime rates.

The micro-forest has as we have seen restorative effects on human health and well-being through its biodiversity affecting the human immune-system and by the lesser demands that just being in nature will have on the human perception. The hybrid micro-forest have besides these effects also an instorative effect that is beneficial to human health and well-being. By promoting human activity and creative play a hybrid micro-forest facilitates movement, problem-solving and cooperation. It strengthening teamwork and our communicative skills having not only effect on our physical health but also improves our self-esteem and self-confidence. Increased social interaction and bodily self-awareness are making us more satisfied and harmonious. Regarding human health and well-being it seems that the plantation of micro-forests in the urban landscape support all the three

ways that a higher degree of contact with nature promotes better health and well-being; by physical activity and social interaction, by creating positive feelings and less demands on attention and through an increased strength of the immune system through biodiversity (Yin et al 2023, p 2-3).

In this study we have seen an overwhelming focus of green infrastructure, human well-being and health, biodiversity, and mitigating effects of climate change in the major governing documents of our studied cities. The strategies and goals in these governing documents are pushing their way through into the planning processes of the cities. In the interviews we have seen an understanding of the importance of urban forestry for the benefit of man and for the possibility to create an environmental-friendly, people-friendly city. We have also seen that external stakeholders both from private enterprises but also from the civil society are taking initiative to construct sites of micro-forests in Malmö. Regarding forest and micro-forests influence on human well-being and health, there seems to be a strong general understanding of the benefits from nature and forestry. There is also focus on the importance of recreational spaces, green and blue environments within urban landscapes and that this has beneficiary effects on human well-being and health. If this also is true on the effects from micro-forests becomes more unclear, especially since the concept of micro-forest is not established in the general knowledge of either the public or amongst civil servants with professional responsibilities for city planning and development. That conclusion seems to be even more true with all the benefits attainable from the hybrid micro-forest that we have seen, even when evidence exist in front of us. We only have to investigate the effects of already existing outdoors pre-schools that are in operation in most cities.

We can therefore answer the question if urban planners, decision-makers and other stakeholders are aware of the benefits of micro-forests, urban forestry and green infrastructure with both a yes and a no. They know and work for more greenery in the urban landscape and they know about the benefits of trees and urban forestry. But they are less knowledgeable in general of micro-forests and even more so of the multiple benefits of the hybrid micro-forest. Therefore there is a mission to be done here for the benefit of the many. The mission to promote a nation-wide effort to implement multipurpose hybrid micro-forests in our modern dense cities. So to conclude. Just do it! Build at least ten health promoting, community building, hybrid micro-forest in each major urbanization in Sweden, benefiting society, the environment and the individual human being.

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# Appendix 1 Questionnaire

## Questionnaire - Ankarparken I Malmö

Studentprojekt 2024-03-20

Sveriges Lantbruksuniversitet vill ställa några frågor om vad du som besökare i Ankarparken tycker om denna plats i Västra Hamnen. Du kan besvara frågorna direkt på detta dokument eller använd följande länk och svara på frågorna ONLINE: <https://sv.surveymonkey.com/r/5Z9P7YX>

### FRÅGOR:

#### 1. Hur upplever du Ankarparken?

	Mysig		Omslutande
	Steril		Lugn
	Öppen		Bullrig

Beskriv med egna ord vad du tycker om parken.

#### 2. Vad tycker du bäst om med Ankarparken?

	Vattenbrynet/Kanalén		Skogsdungarna
	Sittplatser		Gräsmattorna

Vad uppskattar du mest med parken? Är det något du saknar?

#### 3. Vad brukar du göra i Ankarparken?

Välj bara ett svar!

	Passera förbi		Leka/Vara aktiv
	Rasta hunden		Äta
	Vila		Umgås/Träffa folk
	Titta på folk		

Annat Vad?

#### 4. Hur känner du dig innan du är i parken?

Välj bara ett svar!

	Stressig
	Lugn

	Varken eller
--	--------------

Annat?

--

**5. Hur känner du dig efter att ha varit i parken? Välj bara ett svar!**

	Stressig
	Lugn
	Varken eller

Annat?

--

**6. Hur ofta är du i Ankarparken? Välj bara ett svar!**

	Flera gånger om dagen		Några eller någon gång i månaden
	Någon gång varje dag		Mer sällan
	Några eller någon gång i veckan		

**7. Hur länge brukar du stanna? Välj bara ett svar!**

	Mindre än 5 minuter		Mellan 10 och 20 minuter
	Mindre än 10 minuter		Mer än 20 minuter

**8. Hur nära Ankarparken bor/jobbar du? Välj bara ett svar!**

	I husen bredvid		I Malmö
	På nära gångavstånd (inte mer än 300 meter)		Utanför Malmö
	På längre gångavstånd		

**9. Vem är du?**

	Man		Annat
	Kvinna		Vill inte ange

**10. Hur gammal är du?**

	18 år eller under		45-59 år
	19-29 år		60-74 år
	30-44 år		75 år eller mer

**Tack för hjälpen.**

## Appendix 2 Online Link to Questionnaire

**VILL DU GÖRA DIN ÅSIKT HÖRD?**

**Vi behöver din hjälp.**

**VAD TYCKER DU OM ANKARPARKEN I VÄSTRA HAMNEN?**

**EN ONLINE-UNDERSÖKNING FRÅN SLU -**

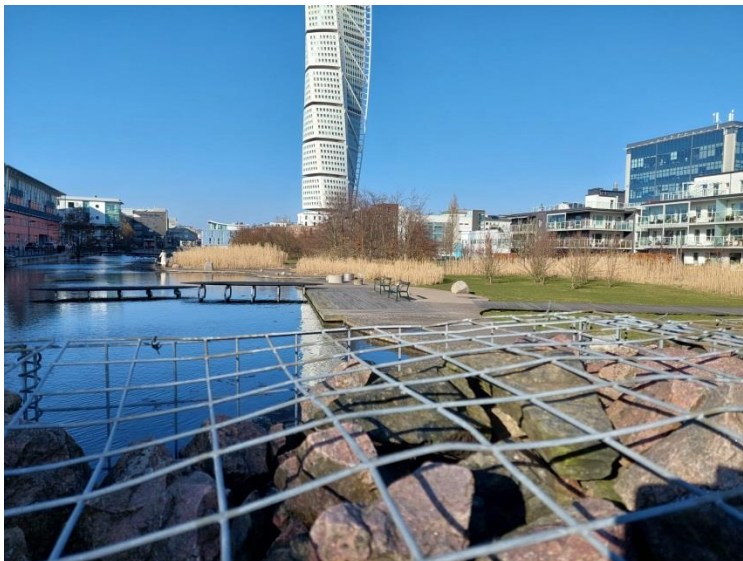
**(SVERIGES LANTBRUKSUNIVERSITET)**

Studentprojekt VT 2024

Tidsåtgång 2-3 minuter

Helt anonymt

[HTTPS://SV.SURVEYMONKEY.COM/R/5Z9P7YX](https://sv.surveymonkey.com/r/5Z9P7YX)



## Appendix 3 Interview Helsingborg

Frågor Intervju HBG Elias Halling – 22 mars

Information om formalia, anonymitet och rätt att avbryta, etc.

1. Berätta lite om din bakgrund, dig själv? Berätta om ditt arbete, din enhet och hur ni jobbar?
2. Jag tänker på placeringen av planteringarna. Hur tänker ni med att dessa skall vara nära dagis, förskolor och bostadsområden?
3. Folk gillar ofta ordning i stadens natur. Hur jobbar ni med kommunikation och information?
4. Är buller en faktor när ni planterar? Spelar mikroskogars förmåga att ge bullerskydd någon roll vid placeringen?
5. Helsingborgs vision, Vad vill Helsingborg skapa med sitt miljöarbete för en grön stad?
6. Om vi tittar på arter i planteringarna, du har ju varit inne på barrträd och deras höga reningseffekt. Hur har ni tänkt på arter i planteringarna?
7. Appropå utmaningar, du har sedan 2020 planterat 17 mikroskogar. Hur ser du på svårigheter och fördelar med mikroskog kontra traditionella planteringar? Vad har du upplevt där?
8. Du har nämnt ekologer och så. Jag tänker på samverkan med olika delar i staden och stadsutvecklingsprocessen. Hur kopplar ni in i varandra?
9. Samverkan medborgarna? Utsatta områden?
10. Mäta effekterna på planteringarna (Kolupptag, medborgarnas uppfattning, etc.) Är det något ni gör?
11. Är det något vi inte tagit upp, som du vill ha sagt?



## Appendix 4 Interview Malmö

Frågor intervju Agneta Stadsmiljöenheten - Malmö 27 mars  
Information om formalia, anonymitet och rätt att avbryta, etc.

1. Berätta lite om din bakgrund, Dig själv, ditt arbete, din enhet, hur ni jobbar?
2. Om man ser på de olika områdena i Malmö, var kommer uppdragen ifrån?
3. Grundläggande visioner och inspiration. Hur får ni kunskap om vad som är bra att göra? Bra för människors rekreation och miljöfaktorer, etc?
4. Hur jobbar ni med mätningar av vilken effekt era åtgärder får?
5. När ni drar igång ett projekt, hur jobbar ni med samverkan intern/externt? Byggbolag, etc?
6. Har ni utvecklat ett mikroskogstänk? Någonting runt urbana skogar, trädtäckning i staden eller så?
7. Vad är du mest stolt över i jobbet? Något område (i staden) eller ekosystemtjänst eller vad som helst?
8. Om du skulle få önska dig något i ditt uppdrag som skulle hjälpa dig. Vad skulle det vara?
9. Har jag glömt något? Är det något du vill säga?

## Appendix 5 Interview MKB

Frågor intervju MKB Augustenborg med Elin Fränge, 22 april 2024.  
Information om formalia, anonymitet och rätt att avbryta, etc.

1. Berätta för mig om mikroskogsprojektet? Hur har ni tänkt när ni vill sätta igång detta projekt? Fördelar? Nackdelar? Tänkt resultat?
  - a. Ni har alltså ett fokus på en hybrid mellan renodlad Miyawaki micro-forest och en hybrid med plats för aktiviteter?
  - b. Jobbar ni med förskolor, dagis för eco-utbildningar?
  - c. Ser du en roll för frivillig organisationer i arbetet med eco-education?
2. Hur har ni jobbat och hur jobbar ni på MKB (Augustenborg) för att få in gröna naturvärden och skapa en hållbar stadsdel?
3. Hur jobbar ni med projekt idag med de boende för att öka engagemang och ansvar? För att skapa platsengagemang och gemenskapshets känsla?
4. Är det något jag glömt? Något som du gärna vill berätta om?

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